RECORD OF DECISION

SPECTRON, INC.
SUPERFUND SITE
OPERABLE UNIT 1

ELKTON, CECIL COUNTY, MARYLAND

U.S. ENVIRONMENTAL PROTECTION AGENCY
REGION 3, PHILADELPHIA, PENNSYLVANIA
September 2004

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I. DECLARATION

SPECTRON, INC.
SUPERFUND SITE
OPERABLE UNIT 1

ELKTON, CECIL COUNTY, MARYLAND

RECORD OF DECISION
Spectron, Inc. Site
OPERABLE UNIT ONE

DECLARATION

Site Name and Location

Spectron, Inc. Site
Elkton, Cecil County, Maryland
CERCLIS ID Number MDD000218008

Statement of Basis and Purpose

This decision document presents the selected remedial action for operable unit one ("OU 1") at the Spectron, Inc. Superfund Site ("Site" also known as "Galaxy/Spectron, Inc Site") located in Elkton, Cecil County, Maryland, (see Figure 1) which was chosen in accordance with the requirements of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 ("CERCLA"), as amended, and, to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan ("NCP"), 40 C.F.R. Part 300. This decision document explains the factual and legal basis for selecting the remedial action for OU 1 at this Site. The information supporting this decision is contained in the Administrative Record for this Site.

The Maryland Department of the Environment ("MDE") concurs with the selected remedy.

Assessment of the Site

Pursuant to duly delegated authority, I hereby determine, pursuant to Section 106 of CERCLA, 42 U.S.C. § 9606, that actual or threatened releases of hazardous substances from this Site, if not addressed by implementing the response action selected in this Record of Decision ("ROD"), may present an imminent and substantial endangerment to public health, welfare, or the environment.

Description of the Remedy

OU 1 is the first phase of a two phase remedial action for the Site. OU 1 addresses a portion of the Site known as the "Plant Area," which comprised the main operating and disposal areas of the former Galaxy Chemicals, Inc., Solvent Distillers, Inc. and Spectron, Inc. solvent recycling operations. These solvent distilling operations have left residual contamination which remains bound to the soil particles in the overburden. This residual contamination is considered to be a principal threat waste since it is a continuous source for ground water contamination. The selected remedy utilizes the existing ground water containment, collection, and treatment system that was constructed during a removal action, but adds a low-permeability plastic cap over the Plant Area's contaminated soil, with an enhanced *in-situ* reductive dechlorination process to degrade contamination in the overburden, and institutional controls to protect the integrity of these systems and prohibit ground water exposure. The second phase, operable unit two ("OU

2”), will address contamination in the fractured bedrock at the Site, residential wells, and any other remaining items (such as a one-acre Office Area located across Little Elk Creek from the main Plant Area [see Figure 2], and any ecological risks in Little Elk Creek downstream of the Plant Area).

More specifically, the selected remedy for OU 1 includes:

1. Continued operation and maintenance of the existing ground water containment, collection, and treatment system which includes the ground water treatment plant, creek liner, concrete cutoff walls, and collection system piping;

2. Demolition to grade, of all structures on the Plant Area (see Figure 2) except the Ground Water Treatment Plant;

3. Moving debris piles to a location on-site where they can be placed under the RCRA (Resource Conservation and Recovery Act) modified cap;

4. Grading of the Plant Area;

5. Installation of a RCRA modified cap across the Plant Area;

6. An *in-situ* reductive dechlorination process or bioremediation of overburden ground water contamination through the addition of an electron donor material;

7. Monitoring to ensure the effectiveness of the remedy;

8. Land and ground water use restrictions, in the OU 1 Area and surrounding area since contamination will remain at the Site.

Data Certification Checklist

The following information is included in the Decision Summary of this ROD. Additional information can be found in the Administrative Record for this Site.

ROD CERTIFICATION CHECKLIST	
Information	Location/Page Number
Chemicals of concern and respective concentrations	Section 7.1.1, Page 10 Tables 1, 2, 3, 4, 5
Baseline risk	Section 7.1, Page 9 Tables 7, 8,
Clean-up levels and the basis for these levels	Section 8, Page 15 Section 11.2, Page 30

ROD CERTIFICATION CHECKLIST	
How source materials constituting principal threat are addressed	Section 2, Page 1 Section 4, Page 4 Section 8, Page 15 Section,11.1 Page 30 Figure 4 and Figure 7
Current and reasonably anticipated future land use assumptions and potential future beneficial uses of ground water	Section 6, Page 8 Section 11.4, Page 38
Potential future land and ground water use that will be available at the Site as a result of the selected remedy	Section 6, Page 8 Section 11.4, Page 38
Estimated capital, annual operation and maintenance, and total present worth costs, discount rate, and the number of years over which the remedy cost estimates are projected	Section 12.3, Page 39 Table 10 and Table 10a
Key factors that led to selecting the remedy	Section 10, Page 21 Section 11.1, Page 30

Statutory Determinations

The selected remedial action is protective of human health and the environment, complies with federal and State requirements that are legally applicable or relevant and appropriate to the remedial action, is cost-effective, and utilizes permanent solutions and alternative treatment (or resource recovery) technologies to the maximum extent practicable.

This remedy also satisfies the statutory preference for treatment as a principal element of the remedy (i.e., reduces the toxicity, mobility, or volume of hazardous substances, pollutants, or contaminants as a principal element through treatment).

Because this remedy will result in hazardous substances remaining on-site above levels that allow for unlimited use and unrestricted exposure, a review will be conducted within five years after commencement of the remedial action to ensure that the remedy continues to provide adequate protection of human health and the environment. Such reviews will be conducted every five years thereafter, until EPA determines that hazardous substances remaining at the Site do not prevent unlimited use and unrestricted exposure at the Site.

______________________________ ____________________

Abraham Ferdas, Director
Hazardous Site Cleanup Division
EPA Region III

Date

II. DECISION SUMMARY

SPECTRON, INC.
SUPERFUND SITE
OPERABLE UNIT 1

ELKTON, CECIL COUNTY, MARYLAND

1.0 SITE NAME, LOCATION AND DESCRIPTION

The Spectron, Inc. Superfund Site ("Site" also known as “Galaxy/Spectron, Inc Site”) consists of an approximately eight acre property located on Providence Road about five miles north of Elkton, Cecil County, Md. (see Figure 1 and Figure 2), and includes the areal extent of contamination from the property. The Site is located in a primarily rural area in a valley, adjacent to Little Elk Creek (“Creek”). The Site contained a former solvent recycling plant. The main portion of the Site (the “Plant Area”) consists of seven acres on the southern banks of Little Elk Creek; another portion of the Site is an approximately one-acre area (the “Office Area”) located on the northern bank of Little Elk Creek. Soil and ground water at the Site are contaminated as a result of past waste disposal activities. The Comprehensive Environmental Response, Compensation, and Liability Information System (“CERCLIS”) identification number for this Site is MDD000218008.

The U.S. Environmental Protection Agency (“EPA”) is the lead agency for Site activities and the Maryland Department of the Environment (“MDE”) is the support agency. EPA has reached prior settlements with potentially responsible parties (“PRPs”) under which the PRPs have performed response actions and maintained the Site.

This action addresses contamination in the overburden soils and ground water at the Plant Area defined by Figure 3 which is considered Operable Unit 1 (“OU 1”). A second phase known as Operable Unit 2 (“OU 2”) is under investigation and is expected to address contamination in the bedrock, the one-acre Office Area, and other areas beyond OU 1 including any contamination continuing to cause ecological risks in Little Elk Creek.

2.0 SITE HISTORY AND ENFORCEMENT ACTIVITIES

The location of the Site was originally a paper mill which burned down in 1946. In 1961, Galaxy Chemicals, Inc. began a solvent recovery operation that treated used solvents and other chemicals generated by the electronics, pharmaceutical, paint, and chemical process industries by removing impurities, and then recycling the clean solvents and chemicals. Galaxy Chemicals went bankrupt in 1975 and the facility was re-opened as Solvent Distillers, Inc., with primarily the same ownership. In 1978 Solvent Distillers, Inc. changed its name to Spectron, Inc. and subsequently closed the facility in 1988 and went into bankruptcy. Sloppy operations, including spills and leaks, allowed contaminants to seep into the soil. Waste sludges containing solvents like trichloroethene (“TCE”) and perchloroethene (“PCE”) were placed into an unlined open air lagoon adjacent to Little Elk Creek. It is likely that the contaminants escaped into the Creek by flowing as a separate phase with the shallow ground water, or by being washed out of the lagoon during storm events. The facility had a history of environmental problems and numerous enforcement actions were taken against its operators by State and Federal regulators.

In addition to historic releases to the air and to the Creek, sampling data indicates that some of the contaminants sank into the soils and cracks (or fractures) in the bedrock below the Site. A September 1982 MDE Order required Spectron to remove the upper six inches of contaminated soil and to add an asphalt cover throughout the Site. This work also included the removal of “Hot Spots” such as the former lagoon. However, recent data from monitoring wells and soil sampling at the Site indicates that contamination in the shallow soils remains.

When Spectron went bankrupt in 1988, it ceased operations, leaving approximately 500,000 gallons of flammable liquids in holding tanks at the Site. EPA, with assistance from MDE, disposed of these wastes. EPA and MDE negotiated an Administrative Order on Consent ("AOC") with the Spectron PRPs to remove and dispose of drums and to clean out flammable sludges from the tanks. Another AOC was signed in 1991 requiring the PRPs to control seeps of contaminated ground water which were leaking out of the shallow soil along the bank of Little Elk Creek and posed a potential public health and ecological threat. The Site has approximately 1,000 PRPs, many of which contributed small quantities of waste.

On October 14, 1992, the Site was proposed to the National Priorities List ("NPL"), which is a listing of the most serious uncontrolled or abandoned hazardous waste sites requiring long term remedial action. The Site was formally added to the NPL on May 31, 1994, making it eligible for Federal cleanup funds.

On September 30, 1996, a Preliminary Public Health Assessment Report was completed by MDE in cooperation with the Agency for Toxic Substances and Disease Registry ("ASTDR"). The report found that in the 1960's and early 1970's, area residences may have been exposed to airborne contaminants. However, sampling, which was conducted in 1995 - 1996 for that report, indicated that there was no current public health hazard from air exposures near the Site. The report recommended a sampling program for local residential wells near the Site, and further recommended treatment of residential wells where contamination was detected. These recommendations have been followed by the PRP group.

Monitoring wells in the bedrock below the Plant Area and Little Elk Creek demonstrate that some of the contamination is present as highly contaminated separate-phase liquids, which have densities greater than water. Since these dense, non-aqueous phase liquids ("DNAPLs") are heavier than water, they have moved through the soils and into the fractures of the bedrock. The DNAPLs at the Site are considered to be a principal threat waste, existing either in a residual, non-mobile form bound to the soil, or in a connected, free flowing liquid form. The DNAPL contamination, in the overburden soils and in the bedrock fractures at the Plant Area, are of concern because the DNAPLs are a continuous source for ground water contamination[1], and people obtain their drinking water from ground water through private wells surrounding the Site. Some residential wells are close to the Creek such that any contamination seeping into the Creek could also impact these wells. The nearest private wells are within several hundred feet of the Site and obtain their water supply mostly from the bedrock aquifer and springs. Continued sampling at nearby residential wells has not detected exceedances of maximum contaminant levels ("MCLs"), which are drinking water standards; however, a few residences have been found to have low levels of site-related contaminants. As a precautionary measure, these residences have been provided with carbon filter systems to remove these trace contaminants.

On May 20, 1996, an Administrative Order on Consent was signed by EPA and the PRPs, requiring the PRPs to continue investigations at the Site and to develop a Remedial Investigation and Feasibility Study ("RI/FS") . These reports and other documentation provided in the

[1] If not for the Ground Water Containment System, described below, this contamination would also act as a continuous source of surface water contamination.

Administrative Record provide the basis for the determinations found in this Record of Decision. The RI/FS is ongoing for the fractured bedrock aquifer, which is a focus of OU 2. That phase of the cleanup includes defining the nature and extent of contamination in the bedrock aquifer and evaluating alternatives for cleaning it up.

In April 1998, EPA, with the assistance of MDE and after soliciting input from the community, decided that a ground water containment, collection, and treatment system (collectively referred to herein as "Ground Water Containment System") would be installed to catch and treat contaminated seeps discharging from the Spectron Site along the Creek bank and contaminated ground water discharging to the Creek. In the fall of 1998, the PRPs began constructing the Ground Water Containment System, which required the excavation of the Creek bed; the installation of a French drain system; and a plastic liner between the Site contamination and Little Elk Creek. The plastic liner or "Creek liner" provides a barrier between the Creek and the contaminated seeps and ground water. By the spring of 1999, the work in the Creek bed was complete.

The Creek was restored by planting native trees and plants along the banks and in the Creek bed itself. The French drains located under the Creek liner collect contaminated ground water, which is then pumped to an on-site ground water treatment plant. The water is treated before being discharged to Little Elk Creek. By the spring of 2000, all the construction work for the Ground Water Containment System was completed, and the plant began treating captured contaminated ground water. The treatment plant uses biological/powder activated carbon ("PAC") treatment tanks. This treatment process allows bacteria, in two 18,000 gallon tanks, to degrade or consume the contaminants in the ground water. In September 2000, the final component of the water treatment system, an air stripper, was turned on. The air stripper is a polishing process for the treated water and removes any residual organic compounds not removed by the biological/powder activated carbon treatment. Under EPA and MDE oversight, the design and construction of these facilities was conducted and financed by the PRPs.

In March 2003, a Federal District Judge in the United States District Court for the District of Maryland finalized a settlement which required *de minimis* parties to pay $5.3 million toward the clean-up of the Spectron Site. The *de minimis* settlement included approximately 500 parties who sent relatively small amounts of hazardous material to the Site. *De minimis* settlements enable smaller waste contributors to help pay cleanup costs in advance and, in exchange, releases them from future financial obligations at sites.

3.0 COMMUNITY PARTICIPATION

The approved Spectron Remedial Investigation, Feasibility Study, and Baseline Risk Assessment, and other Administrative Record documents relating to OU 1, were made available to the public on June 20, 2003. They are located in the Administrative Record, which can be viewed at http://www.epa.gov/arweb, or at the Administrative Record link on the sidebar of the U.S. EPA Region 3 Hazardous Site Cleanup Division Homepage at http://www.epa.gov/reg3hwmd. In addition, the detailed Administrative Record can be examined at the following locations:

Cecil County Library
301 Newark Avenue
Elkton, Maryland

US EPA Region III
1650 Arch Street
Philadelphia, PA 19103
215-814-3157

The notice of the availability of these documents was published in the *Cecil Whig* on June 20, 2003. In addition, EPA sent a fact sheet summarizing the Agency's preferred remedial alternative for OU 1 to residences and businesses within a one-half-mile radius of the Site in June 2003.

From June 20, 2003 to August 20, 2003, EPA held a 60-day public comment period to accept public comments on the remedial alternatives presented in the *Feasibility Study* and the Proposed Plan and the other documents contained within the Administrative Record for the Site. On June 26, 2003, EPA held a public meeting to discuss the Proposed Plan and accept comments. A transcript of this meeting is included in the Administrative Record. The summary of significant comments received during the public comment period and EPA's responses are included in the Responsiveness Summary, which is a part of this Record of Decision.

4.0 SCOPE AND ROLE OF OPERABLE UNIT

Because there are multiple contamination problems at the Spectron Site, EPA has organized the remedial investigations and response actions into two operable units, as outlined above, and as further detailed below. This approach allows steps to be taken to manage the migration of contaminants, mitigate the release or the threat of a release of hazardous substances, and eliminate or mitigate exposure pathways while other studies are undertaken to evaluate additional contamination problems. The problems evaluated and addressed for each operable unit are summarized below:

- Operable Unit 1: Includes actions that are necessary to: 1) prevent ground water contamination from entering Little Elk Creek by using the existing Ground Water Containment System; 2) address principal threat waste (see Figure 4) in the Plant Area overburden ground water; 3) address overburden ground water contamination (ground water within soils and fill overlying the bedrock aquifer in the Plant Area); 4) restrict property use within the OU 1 area, depicted in Figure 3, to protect people from unacceptable exposure to soil contamination and to prevent activities that would interfere with the remedy; and 5) restrict installation of wells within the OU 1 area, depicted in Figure 3, to protect people from unacceptable exposure to ground water contamination.

- Operable Unit 2: Likely to include actions, if necessary, to address contamination in the bedrock and Office Area (see Figure 2), and to address any ecological risks that may be found in Little Elk Creek downstream of the containment system that exists today. Operable Unit 2 may also include any action necessary to provide for the long-term protection of nearby residents consuming ground water from private residential wells.

Some response actions for OU 1 have already been implemented as described in Section 2.0 (Site History and Enforcement Activities) of this ROD, and have mitigated the potential for exposure to contaminated soil. The installation and operation of a shallow ground water containment and treatment system has lessened direct contact with contaminated surface water seeps and ground water along the Creek bank. In addition, the system provides cross-flow flushing, which pushes contaminants toward the treatment system. However, contaminant concentrations in the shallow overburden have remained well above risk levels after three years of ground water flushing.

5.0 SITE CHARACTERISTICS

5.1 Surface Features, Soil and Geology, and Hydrogeology

Surface Features and Resources. The Site is located in the Piedmont Physiographic Province in Cecil County, Maryland within Little Elk Creek Valley (see Figure 1). The main portion of the Site (the "Plant Area") consists of seven acres on the southern bank of Little Elk Creek; another portion of the Site is an approximately one-acre area (the "Office Area") located on the northern bank of Little Elk Creek (see Figure 2). The Plant Area was the primary solvent recycling area and included processing buildings, a power plant building, storage tanks, drum storage areas, and a waste lagoon disposal area ("Lagoon Area"). The owner/operator has removed many of these structures, leaving a large building called the "Power House," a metal pole structure called the "Drum Building," and various tank and equipment foundations (see Figure 2). The Power House building is the only structure that remains from the prior paper mill. This building is structurally unsound and poses safety problems for people in or around the building. A small intermittent stream exists that runs along Ed Moore Road before crossing through a portion of the Plant Area and discharging to Little Elk Creek above the Dam, which is located upstream of the Ground Water Containment System (see Figure 2). A small building, which once housed Spectron's main office and a staging area for tanker trucks and drums, currently exists on the Office Area. While some contamination has been found on the Office Area portion of the Site, additional information will be required to develop an adequate risk-based evaluation. Therefore, the Office Area portion of the Site will be evaluated under Operable Unit 2.

No federally listed or proposed endangered or threatened species are known to exist at the Plant Area, possibly due to the industrial nature of the Site. In addition, an asphalt cap was installed in 1982, followed by the installation of the Ground Water Containment System which isolates the Plant Area from ecological receptors.

Since the Site had a 100-year long industrial history as the Kenmore Paper Mill and is located within the Little Elk Creek Historic District, a Determination of Eligibility ("DOE"), in accordance with the National Historic Preservation Act ("NHPA"), is required. The DOE will provide information to enable the State Historic Preservation Office ("SHPO") to determine if there are significant historic and archaeological resources on the Site and if the Site is on or eligible for placement on the National Register of Historic Places. The SHPO will determine if mitigation is required before any structures are demolished during construction. Mitigation could involve careful documentation through photographs, drawings, and written reports of the paper mill's buildings and lay-out.

Soil and Geology. Observations from drilling and data from monitoring wells from the Plant Area have been compiled in the Remedial Investigation report. This information was used to develop an understanding of the nature of the Site soils and ground water. In addition, this information provides insight to the nature and concentration of the Plant Area contamination. The Plant Area overlies about 4 to 16 feet of soil and fill (also known as overburden), including structural foundations and old drainage piping from the paper mill and recycling plant, which lies directly on top of bedrock. The soils consist of a mixture of sands, silt and clay, with what appears to be a thin, low-permeability silt layer located in the middle of the overburden across most of the Site. This layer is absent near the Creek and may be absent in other areas as a result of filling or construction activities. Contamination was observed above, within, and below this low-permeability layer.

Hydrogeology. The ground water in the overburden aquifer above the bedrock flows toward Little Elk Creek. Ground water flow within the bedrock aquifer also appears to flow toward Little Elk Creek. As a result of the solvent recycling operation at this facility, DNAPLs have been released to the subsurface. These highly concentrated contaminant liquids do not dissolve readily in water, are heavier than water and, therefore, move downward with gravity to sink in and through the soil and ground water until they run into a less permeable clay layer or settle into the fractures of the bedrock. DNAPLs behave as a continuing source of contamination, as up-gradient clean ground water flows through the Site and comes into contact with the DNAPL. Contamination slowly dissolves from the DNAPLs into the ground water that eventually flows to the Ground Water Containment System, or migrates through the bedrock aquifer. Prior to the installation of the Ground Water Containment System, DNAPL-type contaminants were detected in the Creek sediment. Currently, DNAPLs are being recovered from a bedrock monitoring well (AW-1) below the Creek bed.

During the Remedial Investigation, subsurface samples were difficult to collect in the Plant Area, because of the presence of structural foundations. These foundations are suspected to cause, or to have caused, preferential migration pathways for contamination.

This Record of Decision addresses only the contamination in the shallow soil and ground water above the bedrock, within the OU 1 area as shown in Figure 3. As mentioned above, the flow pathway and extent of DNAPL and ground water contamination in the bedrock is continuing to be investigated as part of OU 2.

5.2 Nature and Extent of Contamination

The nature and extent of contamination in certain areas and environmental media at the Site were evaluated during the Remedial Investigation. This information is documented in the Administrative Record and is only briefly summarized in this section of the OU 1 ROD. Greater emphasis is placed here on information regarding the nature and extent of contamination within the Plant Area. More than two hundred surface soil, sediment, and shallow ground water samples were collected from the area associated with OU 1.

5.2.1 Soil and Stock-Piled Soil

Total volatile organic compounds ("VOCs") are present in the Plant Area soils at concentrations ranging from below detection limits to 238 mg/kg (parts per million). The highest levels were identified above the low-permeability silt layer. While VOCs are the dominant contaminants of concern ("COCs"), elevated levels of semivolatile organic compounds, pesticides and metals were found in soils and ground water samples also. The following findings were noted:

• Process areas "F" and "H," located on the Plant Area (see Figure 4), were found to have elevated VOC levels. In general, perchloroethylene ("PCE"), 1,1,1-trichloroethane ("TCA"), 1,1-dichloroethene ("DCE"), and methylene chloride are the most prevalent VOC contaminants throughout the Site. Soil samples indicated that VOCs were present at concentrations ranging from 2 mg/kg to 238 mg/kg. Contaminants such as trichloroethene ("TCE") and PCE comprised the highest concentration of VOCs in most samples in the upper ten feet of soil. However, methylene chloride concentrations increased significantly with depth. The elevated methylene chloride concentrations may be indicative of nearby DNAPL.

• The former Lagoon Area, located on the Plant Area (see Figure 4), also had elevated concentrations of VOCs. In addition, a soil sample (B-1) was noted to have DNAPL present just above the silt layer. The presence of the silt layer theoretically should have slowed the DNAPL migration to the bedrock. However, due to the construction and demolition of the plant buildings at the Site, during its operation as a paper mill and solvent recycling facility, and the resulting installation of foundations and grading of loose fill, the silt layer likely has been breached, thereby facilitating DNAPL migration to bedrock.

Table 1 contains a list of the COCs for the soil and examples of the levels found at the Site.

5.2.2 Ground Water

The contamination in the overburden ground water consists of a wide range of VOCs, SVOCs, pesticides and metals. Some of the more predominant contaminants include acetone, chloroform, methylene chloride, 1,2-dichloroethene, 1,1,1-trichloroethane and tetrachloroethane. Table 2 contains a complete list of the COCs for the overburden ground water, as well as the maximum value detected during the remedial investigation.

Monitoring wells placed in the bedrock below the Plant Area and Little Elk Creek demonstrate that DNAPL contamination exists in some fractures in the bedrock. DNAPLs are heavier than water and therefore sink through the ground water. However, some of the DNAPL remains in a residual form bound to soil particles, like oil in a sponge. The DNAPLs at the Site are considered to be a principal threat waste, existing in either a residual, non-mobile form bound to the soil or in a connected, free flowing liquid form. Highly contaminated samples taken in the overburden ground water indicate the presence of residual DNAPLs. The DNAPL contamination in the overburden at the Plant Area and in the bedrock fractures are of concern, because the DNAPLs are a continuous source for ground water contamination, and people obtain their drinking water from ground water through private wells surrounding the Site. The nearest private wells are within several hundred feet of the Site and obtain their water supply mostly from the bedrock aquifer and springs. Sampling results at nearby residential wells have not exceeded maximum contaminant levels ("MCLs"), which are drinking water standards; however, a few residences have been found to have low levels of site-related contaminants. As a precautionary measure, these residences have been provided with carbon filter systems to remove these trace contaminants and are routinely monitored.

5.2.3 Surface Water

Surface water contamination in Little Elk Creek has been monitored since 1995. Prior to the construction of the Creek ground water collection system, a wide range of volatile compounds were found in the surface water at the Site. Table 3 contains a list of contaminants and examples of concentrations that have been found. There have been significant decreases in total VOC concentrations since the start-up of the Ground Water Containment System in March 2000. Concentrations of VOCs detected just downstream of the containment system were below their respective Maryland Surface Water Quality Standards ("MSWQS") and Federal Ambient Water Quality Criteria ("AWQC") levels for consumption of fish and drinking water in a majority of the samples.

5.3 Conceptual Site Model

A Conceptual Site Model ("CSM") diagrams contaminant sources, contaminant release mechanisms and migration routes, exposure pathways, and potential human and ecological receptors. It documents what is known about human and environmental exposure, under current and potential future Site conditions. The risk assessment and final response action for this Site are based on the CSM.

The CSM for this Site (see Figure 5) illustrates residual DNAPL in the shallow soil being released from an unlined storage lagoon and leaks from the processing equipment. Contamination at the Site was released into the soil, and much of it migrated into the fractured bedrock. Once DNAPLs enter the ground water, they act as a major source of ground water contamination (via dissolution), and surface water contamination (due to discharge of contaminated ground water and/or movement of DNAPLs). Site receptors include individuals who may be exposed to the contaminants in the soil and ground water.

6.0 CURRENT AND POTENTIAL FUTURE LAND USES

Land use within the surrounding area includes a mix of residential, and agricultural activities. Despite the past historical industrial use, the Property (see Figure 2) is zoned for residential use, according to the zoning board of Cecil County, Maryland, and the properties immediately adjacent to the Site are used for residential purposes or are zoned for residential use. U.S. Census Bureau data indicates that Cecil County has experienced significant growth in recent years. Generally, in residential settings, EPA's preference is to clean-up a site so it can be used for residential purposes. However, EPA considers the contamination below the Plant Area to be so pervasive, that there are no technologies available today that could reasonably be expected to return this Area to a condition that would allow residential use. Other public uses may be envisioned if they are designed not to interfere with the selected remedy. These uses could include a community park, development of the Site for commercial use, light industry, or a County utility vehicle maintenance yard, if the local community so chooses. However, public water is currently not available within the vicinity of the Site and area residents, businesses, institutions and industries rely on the ground water as a water source. The Site has a few remaining older structures which are not in use, and a ground water treatment plant, which was installed as part of a removal action. The Plant Area, which comprises most of OU 1, is fenced and generally accessible only to on-site maintenance workers and occasional trespassers.

7.0 SUMMARY OF SITE RISKS

A baseline human health risk assessment was conducted in order to estimate the probability and magnitude of potential adverse human health effects from exposure to contaminants in on-site soil and ground water, assuming no further response actions are undertaken. The human health risk assessment provides the basis for taking action and identifies the contaminants and exposure pathways that need to be addressed by the remedial action at OU 1. An ecological risk assessment was not completed for OU 1, since there were no risks to ecological receptors in the Plant Area after construction of the Ground Water Containment System. However, without the continued operation and maintenance of the containment system, contamination would discharge into Little Elk Creek and could pose a threat to human health and the environment. An ecological risk assessment will be completed for OU 2.

This section of the ROD summarizes the results of the baseline human health risk assessments.

7.1 Summary of Human Health Risk Assessment

The Baseline Risk Assessment ("BLRA") for OU 1 is comprised of a *Baseline Risk Assessment* submitted by the PRP Group, Risk Assessment Addenda prepared by EPA, and comments contained in EPA's April 30, 2003 approval of the BLRA. The BLRA was prepared in order to determine the current and potential future effects of contaminants in soil and ground water in the absence of further cleanup actions at the Site. The BLRA considered the effects of exposure to soil and ground water. The BLRA consisted of a four step process: 1) the identification of chemicals of potential concern ("COPCs"), i.e., those which have the potential to cause adverse health effects; 2) an exposure assessment, which identified actual and potential exposure pathways, potentially exposed populations, and the magnitude of possible exposure; 3) a toxicity assessment, which identified the adverse health effects associated with exposure to each COPC and the relationship between the extent of exposure and the likelihood or severity of adverse effects; and 4) a risk characterization, which integrated the three earlier steps to summarize the potential and actual risks posed by hazardous substances at the Site, including carcinogenic and non-carcinogenic risks. A summary of those aspects of the human health risk assessment, which support the need for remedial action, is discussed below.

7.1.1 Contaminants of Potential Concern

During the Remedial Investigation, approximately eighty-seven organic and inorganic chemicals were detected in the Plant Area subsurface soils. Chemicals with maximum concentrations and/or analytical method detection limits of less than Risk-Based Concentrations ("RBCs")[2] were eliminated from further consideration in the risk assessment. As a result, twenty-two of the chemicals were selected as soil COPCs for the BLRA, and fifty-three chemicals were selected as on-site overburden ground water COPCs. Risk calculations were based on either the upper 95th percentile confidence limit on the mean ("UCL95") or the maximum detected concentration for each chemical. The lower of these two values (designated the "medium-specific concentration" ["MSC"]) was used in the risk calculations as the exposure point concentration for that chemical in that medium. Tables 4 and 5 list the COPCs and their respective exposure point concentrations for the Plant Area soil and the overburden ground water.

7.1.2 Exposure Assessment

Potential human health effects associated with exposure to the COPCs were estimated quantitatively or qualitatively through the evaluation of several actual or potential exposure pathways. These pathways were developed to reflect the potential for exposure to hazardous substances on the Plant Area. Demographics and land use were evaluated to assess present and potential future populations living, working or otherwise spending time at or in the Plant Area. The exposure scenarios evaluated in the *Baseline Risk Assessment* are presented below.

The *Baseline Risk Assessment* considered the effects of ingestion of, and dermal contact with, soils and ground water in the Plant Area. The BLRA also considered the inhalation of chemical volatilization from ground water and dermal contact while showering.

Six different future exposure scenarios were developed in order to estimate risks for the following populations: 1) on-site industrial worker; 2) on-site construction worker; 3) on-site utility worker; 4) on-site trespasser; 5) on-site resident adult; and 6) on-site resident child.

A number of assumptions were used in the risk assessment process to calculate the dose for each exposure pathway since it is seldom possible to measure a specific dose. The following assumptions were used to estimate reasonable maximum exposure for each of the six populations identified above:

On-site industrial worker

- The on-site industrial worker was assumed to have a body weight of 70 kilograms ("kg").
- The exposure duration was 25 years.
- The frequency of exposure to soil, ground water and air emissions was assumed to be 250 days per year ("days/yr").
- The soil ingestion rate was assumed to be 50 milligrams per day ("mg/day").
- The skin surface area for dermal contact was assumed to be 2,500 square centimeters ("cm^2").

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[2] The identification of chemicals of potential concern was performed utilizing the EPA guidance, "Selecting Exposure Routes and Contaminants of Concern by Risk-Based Screening" (EPA Region III, 1992).

- A soil-to-skin adherence factor of 0.6 milligrams per square centimeter ("mg/cm^2") was used.
- The inhalation rate was assumed to be 20 cubic meters per day ("m^3/day").
- Ground water ingestion rate was 1L/day. The worker was assumed to shower at work also.

On-site construction worker

- The on-site construction worker was assumed to have a body weight of 70 kg.
- The exposure duration was 1 year.
- The frequency of exposure to soil and air emissions was assumed to be 125 days/yr.
- The soil ingestion rate was assumed to be 480 mg/day.
- The skin surface area for dermal contact was assumed to be 2,500 cm^2.
- A soil-to-skin adherence factor of 0.6 mg/cm^2 was used.
- The inhalation rate was assumed to be 20 m^3/day.
- The construction worker was assumed to be in contact with ground water in excavations up to 8 hr/day.

On-site utility worker

- The on-site utility worker was assumed to have a body weight of 70 kg.
- The exposure duration was 1 year.
- The frequency of exposure to soil and air emissions was assumed to be 10 days/yr.
- The soil ingestion rate was assumed to be 400 mg/day.
- The skin surface area for dermal contact was assumed to be 2,500 cm^2.
- A soil-to-skin adherence factor of 0.6 mg/cm^2 was used.
- The inhalation rate was assumed to be 20 m^3/day.

On-site trespasser

- The body weight of the trespasser was assumed to be 50 kg.
- The exposure duration was 10 years.
- The frequency of exposure to soil and air emissions was assumed to be 52 days/yr.
- The soil ingestion rate was assumed to be 100 mg/day.
- The skin surface area for dermal contact was assumed to be 6,025 cm^2, based on area of face, upper extremities, and lower legs.
- A soil-to-skin adherence factor of 0.6 mg/cm^2 was used.
- The inhalation rate was assumed to be 20 m^3/day.

On-site Resident Adult

- The on-site resident adult was assumed to have a body weight of 70 kg.
- The exposure duration for the on-site resident was divided between 6 years of childhood exposure and 24 years of adult exposure.
- The frequency of exposure to soil and air emissions was assumed to be 350 days/yr.
- The soil ingestion rate was assumed to be 100 mg/day.
- The skin surface area for soil dermal contact was assumed to be 5,000 cm^2.

- The skin surface area for ground water dermal contact was assumed to be 18,150 cm^2.
- A soil-to-skin adherence factor of 0.6 mg/cm^2 was used.
- It was assumed that the on-site resident adult inhales 20 m^3/day.
- The ground water ingestion rate was assumed to be 2 L/day.

On-site Resident Child

- The assumed body weight for children was 15 kg.
- The exposure duration for the on-site resident was divided between 6 years of childhood exposure and 24 years of adult exposure.
- The frequency of exposure to soil and air emissions was assumed to be 350 days/yr.
- The age-specific soil ingestion rate for children was 200 mg/day.
- The skin surface area for soil dermal contact was assumed to be 2,800 cm^2.
- The skin surface area for ground water dermal contact was assumed to be 7,685 cm^2.
- A soil-to-skin adherence factor of 0.6 mg/cm^2 was used.
- It was assumed that the on-site resident child inhales 12 m^3/day.
- The ground water ingestion rate was assumed to be 1 L/day.

7.1.3 Toxicity Assessment

Excess lifetime cancer risks were determined for each exposure pathway by incorporating the chemical specific cancer slope factor. Cancer slope factors have been developed by EPA from epidemiological or animal studies to reflect a conservative "upper bound" of the risk posed by potentially carcinogenic substances. The resulting risk estimates are expressed in scientific notation as a probability (e.g., 1×10^{-6} or 1/1,000,000) and indicate (using this example) that an average individual is not likely to have greater than a one in a million chance of developing cancer over 70 years as a result of site-related exposure to the compound at the stated concentrations. All risks estimated represent an “excess lifetime cancer risk,” or the additional cancer risk on top of that which we all face from other causes such as cigarette smoke or exposure to ultraviolet radiation from the sun. EPA’s generally acceptable risk range for site-related exposure is 10^{-4} to 10^{-6}. Current EPA practice considers carcinogenic risks to be additive when assessing exposure to multiple hazardous substances or exposure via multiple pathways.

In assessing the potential for exposure to a chemical to cause adverse health effects other than cancer, a hazard quotient (“HQ”) is calculated by dividing the daily intake level by the reference dose (“RfD”) or other suitable benchmark. EPA has developed reference doses for many chemicals which represent a level of exposure that is expected to result in no adverse health effects. RfDs are derived from epidemiological or animal studies and incorporate uncertainty factors to help ensure that the potential for adverse health effects will not be underestimated. An HQ ≤ 1 indicates that a receptor’s dose of a single contaminant is less than the RfD and that harmful non-cancer effects from that chemical are unlikely. The Hazard Index (“HI”) is generated by adding the HQs for all COPCs that affect the same target organ (e.g., liver) within or across those pathways by which the same individual may reasonably be exposed. An HI ≤ 1 indicates that harmful non-cancer health effects are not expected as a result of exposure to all of the COPCs within a single or multiple exposure pathway(s).

A summary of the cancer and non-cancer toxicity data relevant to the COPCs in the *Baseline Risk Assessment* is presented in Table 6.

7.1.4 Risk Characterization

For the populations and exposure scenarios considered for the Plant Area in the *Baseline Risk Assessment* as shown on Table 7 and Table 8, the total excess lifetime cancer risk for the future on-site industrial worker, future on-site construction worker, future on-site resident adult, and future on-site resident child each exceed the 1×10^{-4} to 1×10^{-6} risk range discussed above. Specifically, the total excess lifetime risks are 2.3×10^{-1}, 3.0×10^{-3}, 4.4×10^{-1}, and 7.4×10^{-1}, respectively, for these receptors. The carcinogenic risk for the future on-site utility worker (3.0×10^{-7}) and the future on-site trespasser/visitor (2.0×10^{-5}) were within or below the 1×10^{-4} to 1×10^{-6} risk range.

As shown on Table 7 and Table 8, the hazard indices for the future on-site industrial worker, future on-site construction worker, future on-site resident adult, and future on-site resident child each exceed the hazard index of unity (1). Specifically, the hazard indices are: 2,650; 433; 4,622; and 4,732; respectively, for these receptors. The hazard indices for the future on-site utility worker (0.1) is less than unity, and future trespasser/visitor (1.4) is greater than unity. However, the HI does not truly exceed 1 for the future trespasser/visitor since the chemicals affect different target organs.

The predominant pathways contributing to the increased cancer and the non-cancer risk is ingestion of on-site ground water, inhalation of vapors from on-site ground water, and dermal contact with on-site ground water. Volatile organics present at highly elevated concentrations in on-site ground water are the predominant risk drivers. As shown on Table 7 and Table 8, the risk for all non-residential receptors would be within or below the 1×10^{-4} to 1×10^{-6} cancer risk range and at or below unity for the HI, if ground water is excluded from the estimate of excess lifetime cancer risk and the hazard index.

7.1.5 Uncertainty in Risk Characterization

Risk assessment provides a systematic means of organizing, analyzing and presenting information on the nature and magnitude of risks posed by chemical exposures. Uncertainties are present in all risk assessments because of the quality of available data and the need to make assumptions and develop inferences based on incomplete information about existing conditions and future circumstances. Below is a brief discussion of the major uncertainties associated with the *Baseline Risk Assessment*.

- Dermal Contact Pathway - The use of adjusted toxicity values for the assessment of dermal risks is a source of uncertainty in the risk assessment. Adjusted oral toxicity values were generated based on currently available oral absorption factors. Adjustment factors ranging from less than 1 percent (inorganic) to 100 percent (VOCs) were applied to toxicity values to account for absorbed doses.

- Risk Characterization - Constituent-specific risks are generally assumed to be additive. This oversimplifies the fact that some constituents are thought to act synergistically

(1 + 1 > 2) while others act antagonistically (1 + 1 < 2). The overall effect of these mechanisms on multi-constituent, multi-media risk estimates is difficult to determine but the effects are usually assumed to balance.

- There is inherent variability in environmental sampling results, given the spatial distribution of contamination and composition of the matrix sampled. Small numbers of samples may not completely characterize the numbers and concentrations of constituents actually present.

- Exposure parameters for the Site risk assessment were obtained from EPA guidance or peer review literature. Most of these assumptions are considered average or reasonable maximum exposure estimates that would not likely underestimate exposure. While there are situations where the parameters may produce underestimates, it is unlikely that the cumulative effect of all exposure parameter estimates will lead to underestimates of risk.

7.1.6 Principal Threat Waste

The National Oil and Hazardous Substances Pollution Contingency Plan ("NCP") establishes an expectation that EPA will use treatment to address the principal threats posed by a Site wherever practicable (40 C.F.R. Section 300.430(a)(1)(iii)(A)). The "principal threat" concept is applied to the characterization of "source materials" at a Superfund site. A source material is material that includes or contains hazardous substances, pollutants or contaminants that act as a reservoir for migration of contamination, for example, to ground water. Principal threat wastes are those source materials considered to be highly toxic or highly mobile, which would present a significant risk to human health or the environment should exposure occur.

For OU 1 at the Spectron Site, DNAPL, whether in residual or free-flowing form, is considered principal threat waste because it acts as a reservoir for continued ground water contamination. EPA believes that DNAPL, likely in a residual form, is in the overburden ground water because 1) free flowing DNAPL is present in the bedrock and would have migrated through the overburden ground water to reach its present location, and 2) the high level of contamination in the overburden ground water indicates that DNAPL may be present.

7.2 Summary of Ecological Risk Assessment

An ecological risk assessment was not required under OU 1 (Shallow Soil Contamination), but will be necessary under OU 2 (Bedrock Contamination). The asphalt in the former Plant Area and the Ground Water Containment System prevent ecological receptors from coming into contact with contaminants; therefore, a risk assessment was unnecessary. However, the Ground Water Containment System must continue to be maintained to prevent releases which could pose potential risks to ecological receptors in Little Elk Creek.

7.3 Conclusion of Baseline Risk Assessment

The *Baseline Risk Assessment Report* concluded that risks to an on-site adult resident, child resident, industrial worker, and construction worker exceed NCP target risk levels for carcinogenic and non-carcinogenic risks. EPA has determined that the remedial action selected in this ROD is necessary to reduce the risks for these receptors to within or below EPA's risk range.

In addition, the Ground Water Containment System must continue to be maintained to prevent releases which could pose potential risks to ecological receptors in Little Elk Creek.

8.0 REMEDIAL ACTION OBJECTIVES

Based on the information relating to the types of contaminants, environmental media of concern, and potential exposure pathways, Remedial Action Objectives ("RAOs") were developed to aid in the development and screening of alternatives. EPA has established the following RAOs to mitigate and/or prevent existing and future potential threats to human health and the environment:

- Ensure continued operation and maintenance of the previously constructed Ground Water Containment System,[3] so that Federal Ambient Water Quality Criteria ("AWQC") for consumption of fish and drinking water are not exceeded within Little Elk Creek, immediately downstream of the Ground Water Containment System. This is necessary to address potential risks to human health and ecological risks that may occur if the operation were discontinued and contamination were to enter Little Elk Creek. Continued operation and maintenance includes ensuring that the ground water treatment plant has adequate capacity. The maintenance of the liner is also necessary to prevent the re-establishment of the seeps along the Creek banks, which existed prior to the installation of the liner;

- Prevent current or future direct contact with contaminated soils, which would result in unacceptable levels of risk to human health. Unacceptable levels of risk include those that exceed the excess lifetime cancer risk of 1×10^{-6}, and Hazard Indices of greater than 1 for current and potential future direct contact with soil,

- Prevent current or future use (ingestion, direct contact, or vapor inhalation) of contaminated ground water which would result in unacceptable levels of risk to human health. Unacceptable levels of risk include those that exceed the excess lifetime cancer risk of 1×10^{-6}, and Hazard Indices of greater than 1 for current and potential future direct contact with ground water; and,

- Remove DNAPL in the overburden (principal threat waste), to the maximum extent practicable, to minimize the continuing source of contamination to ground water.

[3] Key components of the Ground Water Containment System are identified in the Spectron Removal Action Construction Certification Report, dated January 24, 2000.

9.0 SUMMARY OF REMEDIAL ALTERNATIVES

9.1 Remedial Alternatives Common Elements

The alternatives which were considered for the Site, for the cleanup of contaminated shallow soil for OU 1, are discussed in detail in the *Feasibility Study Report,* dated June 2001, and the *Addendum Feasibility Study Report*, dated April 9, 2002. These remedial alternatives are summarized below and are numbered to correspond with the numbers in the *Feasibility Study*.

Each alternative, except the "no action" alternative, contains some common elements that were considered in the evaluation process. The common elements include:

1. O & M of the existing Ground Water Containment System

The continued operation and maintenance ("O & M") of the existing Ground Water Containment System, described above. This Ground Water Containment System has successfully captured and treated contaminated ground water from the shallow soils and deep bedrock since March 2000. The mass of contaminants in the shallow soil ground water would very slowly decline, due to the natural flushing of the ground water, as it travels to the containment system. However, due to Site conditions, including persistent DNAPL that has settled in some of the cracks of the bedrock, it is anticipated that the containment system will be operated long into the future. The annual O & M cost for the Ground Water Containment System is estimated at $360,000. This amount is reflected in the O & M Cost of each alternative.

2. Evaluation of the existing Ground Water Containment System

   a. During the remedial design, the capacity of the ground water treatment plant system shall be evaluated, and expansion or upgrades shall be carried out. Expansion/upgrades could include such things as increased pump capacity, increased treatment capacity through the addition of another bioreactor tank, and/or use of the existing emergency treatment capacity if the increased need is seasonal. Another possible upgrade could be the addition of shallow pumping wells on the plant side of the Creek near the downstream end of the containment system, if it is determined that shallow ground water is migrating beyond the end of the containment system. It is possible that deeper bedrock ground water could be discharging into the Creek beyond the containment system. This issue will be addressed by the on-going bedrock ground water studies being conducted as part of Operable Unit 2.

   b. EPA recognizes that a contaminant, 1,4-dioxane, can be present where there are high levels of TCA. Given that this Site was occupied by a solvent recycling operation and that there are high concentrations of TCA present in ground water, 1,4-dioxane may be present in the ground water as well. If present, it is possible that this contaminant is not being treated by the existing treatment technologies in place at the Site. Consequently, the remedial design will include evaluating whether the Ground Water Containment System influent and effluent contains

1,4-dioxane, and will evaluate and implement any modification to the existing treatment to address 1,4-dioxane if concentrations pose an unacceptable risk to human health or the environment, based on NCP criteria.

3. Structure Demolition

The demolition, to grade, of all structures on the Plant Area (see Figure 2) except the new ground water treatment plant building and tanks, and the regrading of concrete debris, along with the stock-piled site soils[4] that were originally removed from Little Elk Creek, prior to the installation of the Ground Water Containment System. Demolition is necessary: (1) because the structures are deteriorating and unsound, and (2) to facilitate installation of a continuous protective cover across the Plant Area.

4. Property Use Restrictions

Certain property use restrictions to prevent activities that could adversely affect the protective cover (a component of each alternative except the "no action" alternative) or other components of the remedy, or which could result in unacceptable exposure risks related to contaminated soil. These restrictions will be implemented through institutional controls within the OU 1 area, to prohibit the construction of buildings or other activities that could compromise the integrity of the protective cover.

5. Well Drilling Restrictions

Prohibition of well drilling within the OU 1 area, to prevent unacceptable exposure to contaminated ground water via ingestion, vapor inhalation or dermal contact. This will be implemented through institutional controls.

6. Debris Pile Relocation

Remove the debris pile northwest of the Dam, to grade, and relocate to the Plant Area, where it will be covered by a protective cover.[5]

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[4] These stockpiled soils were sampled in February 2003 and found to have low levels of contamination.

[5]While no contamination was found in this debris pile during the remedial investigation, the amount of sampling was not adequate to determine that no contamination is present. Reports are that the debris pile (soil with chunks of asphalt) came from the waste lagoon in the Plant Area. Given the high likelihood of contamination, the small size of the pile and the proximity to the area to be capped or covered, EPA has determined that the pile should be consolidated underneath the cap or cover.

9.2 Remedial Alternatives

Alternative 1 No Action

Capital Cost:	$0
Annual O&M Costs:	$0
Total Present Worth Cost:	$0

Under this alternative, no remedial measures would be implemented at the Site to prevent exposure to the soil and ground water contamination. In addition, the operation of the Ground Water Treatment System would discontinue.[6] The "no action" alternative is included because the NCP requires that a "no action" alternative be developed as a baseline for evaluating other remedial alternatives.

Alternative 2 Soil Cover with Phytoremediation

Capital Cost:	$2,119,581
Annual O&M Costs:	$445,000
Total O&M Costs:	$7,031,000
Total Present Worth Cost:	$9,150,581

In addition to the common elements described above, this alternative involves the installation of a 24" soil cover over the Plant Area (see Figure 6) and planting of poplar trees throughout the area to reduce water in the overburden and to remove contaminants through phytoremediation.

The primary objective of the soil cover is to cover the impacted soil with a clean soil layer to eliminate the potential for direct contact with the contaminated soil and to reduce the amount of rain water that infiltrates into the contaminated soil. The poplar trees would help remove ground water contamination through phytoremediation. Phytoremediation is a cleanup technology that utilizes plants or trees to control water flow and/or to treat soil and ground water. Poplar trees were considered for this Site based on their ability to withdraw large amounts of water relative to other trees and their ability to "treat" certain ground water contaminants including some of those found at the Site. Treatment mechanisms associated with phytoremediation using poplar trees include biodegradation of contaminants in the rhizosphere (root zone), adsorption on the root structure, enzyme degradation within the tree, and volatilization through the leaves via transpiration. By withdrawing water, the trees would reduce the water load on the treatment plant.

Routine maintenance would be required to maintain the soil cover integrity. Maintenance activities could include lawn mowing and lawn care to maintain the vegetative cover, and repairing potential erosional features and/or subsidence.

[6] The operation could continue under the existing Removal Consent Order. However as part of EPA's general policy, EPA has always intended to incorporate the operation and maintenance of the containment system into the remedial actions to be implemented at the Site.

Alternative 3 In-Situ Treatment with Engineered Cover System and Institutional Controls

Capital Cost:	$2,029,148
Annual O&M Costs:	$472,333
Total O&M Costs:	$7,462,867
Total Present Worth Cost:	$9,492,014

In addition to the common elements described above, this alternative involves the installation of an engineered cover system over an approximately 3-acre area of the Plant Area (see Figure 7). The cover system would be a modified RCRA (Resource Conservation and Recovery Act) cap, which includes (from bottom to top): a soil sub-base, a geosynthetic composite clay liner, a plastic geomembrane, a geosynthetic drainage layer, 18" of soil, and 6" of topsoil. This cover system would minimize the potential for direct contact with contaminated soil and practically eliminate the infiltration of rain water into the contaminated soil. In addition, to minimize vapor build-up under the low-permeability cover, a passive venting system would be installed. The emissions from the passive venting system would be evaluated during the remedial design phase and, if necessary, steps would be taken to control emissions to ensure the protection of human health and the environment. Maintenance activities similar to those described in Alternative 2, above, would take place for the cover.

The principal threat waste (the DNAPL material in the overburden soils) would be treated using an enhanced *in-situ* reductive dechlorination process to degrade contamination in the overburden. This process is also known as biodegradation. Most of the contamination at this Site consists of chlorinated volatile organic compounds which are difficult to biodegrade naturally. By adding another food source for the native bacteria that naturally live in the ground water, the bacteria's ability to biodegrade the chlorinated contaminants greatly increases. This would be accomplished by injecting an electron donor or lactic acid substrate material into the overburden ground water. As an analogy, the electron donor material acts like a vitamin supplement to assist the bacteria in breaking down the chlorinated compounds. In addition, amendments (e.g. inorganic nutrients, organic carbon, peat humic substances, treatment plant discharge water and/or other bacteria) may be used to increase biodegradation rates.

The type of electron donor material and other amendments to be used would be determined during the remedial design with the help of bench-scale treatability studies. An electron donor material could be as simple as molasses or as complex as a commercial product with patented time release capabilities. EPA anticipates that the electron donor material would be injected below the water table at the Site along the existing retaining wall located at the southern portion of the Plant Area. Injection points would be concentrated just upgradient of areas identified as principal threat areas (see Figures 4 and 7). Adding the treatment material in this fashion would be advantageous since the natural ground water "cross flow" would distribute the treatment material across the Plant Area. The method of application would be determined during the remedial design. The electron donor injection would be implemented in a phased approach to further develop information about such things as: changes in ratios of subsurface contaminants versus treatment material and injection rates.

Field-scale pilot studies (over roughly 10-33% of the Plant Area) would be conducted to develop operating parameters to ensure that the treatment does not adversely impact the on-going operation of the ground water treatment plant. Such factors as dissolved iron production, biofouling, and production of daughter products, including vinyl chloride, will be examined. The *in-situ* treatment would be controlled in such a way as to not adversely impact the ground water treatment plant.

The goal of this treatment would be to remove the DNAPL material to the maximum extent practicable to minimize its ability to be an on-going source of ground water contamination. Once the bench-scale treatability studies and field-scale pilot studies were complete, the treatment would be applied throughout the Plant Area. After five years of treatment, EPA would evaluate the on-going effectiveness of the treatment. Treatment activities (injection of electron donor and any amendments and monitoring) would continue until the treatment is no longer contributing significant reductions in contamination. By accelerating the destruction of the DNAPL,[7] potential risks associated with a failure of the containment system and erosion of contaminated soils downstream would be reduced.

Alternative 4 Excavation and Off-Site Disposal with a Soil Cover

Capital Cost:	$8,649,829
Annual O&M Costs:	$375,000
Total O&M Costs:	$5,925,000
Total Present Worth Cost:	$14,574,829

In addition to the common elements described above and the soil cover described in Alternative 2, this alternative consists of excavating contaminated soil, fill, and building foundations from the Plant Area, including the Lagoon Area (the areas where the majority of contamination would most likely have entered the soil). The total area is approximately 2 acres in size (see Figure 8). Only soil in the vadose zone or above the water table would be excavated. The estimated volume of contaminated material requiring excavation is 17,800 cubic yards. The material would be shipped off-site in covered dump trucks for treatment and disposal. Steps would be taken to minimize the air release of contaminants to ensure the safety of the nearby residents. Prior to construction of the soil cover, the excavated areas would be filled-in using currently stock-piled soil, debris from the demolition of the buildings and clean soil from off-site as necessary.

By excavating the most contaminated soil near the surface, any potential for direct contact with contaminated soil would be greatly diminished.

[7]The destruction of the DNAPL is accomplished by biodegrading the dissolved contamination in the ground water, allowing more contamination to dissolve from the DNAPL into the ground water and be degraded. This provides accelerated removal of the DNAPL compared to just flushing with natural ground water flow.

Alternative 5 Soil Vapor Extraction with Engineered Cover System

Capital Cost:	$3,784,648
Annual O&M Costs	$985,000 *(Yr 1 - 10)*
Annual O&M Costs	$395,000 *(Yr 11 - 30)*
Total O&M Costs:	$10,754,500 *(Yr 1 - 30)*
Total Present Worth Cost:	$14,539,148

In addition to the common elements described above and the engineered cover system described in Alternative 3, this alternative consists of using a soil vapor extraction ("SVE") system to address soil contamination above the water table. The extraction system would be installed in approximately the same areas as the soil excavation described in Alternative 4 (see Figure 9). The SVE system would consist of wells attached to a vacuum pump that would extract air from between soil particles. The extracted air would carry contaminants with it. As air is flushed through the soil, the soil would gradually be cleaned up. The air that is extracted during this process would be put through carbon filters to remove the contaminants before discharging to the atmosphere.

In order to increase the amount of soil that could be treated in this way and to subject some of the DNAPL material to treatment by SVE, ground water extraction wells would be installed in the Plant Area to lower the water table so air could be flushed through a greater volume of soil.[8] Additional ground water treatment capacity, through expansion of the existing treatment plant or the addition of some temporary treatment equipment, might be necessary to handle the extra volume of ground water. A problem with lowering the water table is that the free phase (mobile) DNAPLs will drain out of soil pockets and move downward. This would exacerbate the ground water contamination problem.

The SVE system would operate until EPA determines that it is no longer contributing significant removal of contamination from the Plant Area.

10.0 EVALUATION OF ALTERNATIVES

The five remedial alternatives described above were evaluated in detail to determine which would best meet the requirements of the Comprehensive Environmental Response, Compensation and Liability Act of 1980, as amended, ("CERCLA") and the NCP, and achieve the remedial action objectives identified in section 8.0 of this ROD. EPA uses the nine criteria set forth in the NCP, 40 C.F.R. §300.430(e)(9)(iii), to evaluate remedial alternatives. The first two criteria (overall protection of human health and the environment, and compliance with applicable or relevant and appropriate requirements ("ARARs")) are threshold criteria. The selected remedy must meet both of these threshold criteria (except when an ARAR waiver is invoked). The next five criteria (long-term effectiveness and permanence; reduction of toxicity, mobility or volume through treatment; short-term effectiveness; implementability; and cost) are

[8] Another way to enhance an SVE system is to blow air into the water table (called air sparging) to strip contaminants from the ground water into the air which can then be carried to the vacuum wells. Use of this enhancement could be evaluated in the remedial design.

the primary balancing criteria. The remaining two criteria (state and community acceptance) are referred to as modifying criteria and are taken into account after public comment is received on the Proposed Remedial Action Plan.

The following discussion summarizes the evaluation of the five remedial alternatives developed for OU 1 at the Site against the nine evaluation criteria.

Overall Protection of Human Health and the Environment

A primary requirement of CERCLA is that the selected remedial action be protective of human health and the environment. A remedy is protective if it reduces, to acceptable levels, current and potential risks associated with each exposure pathway at a site.

Alternative 1 (No Action) contains no provisions for preventing exposure to contamination, and is not protective of human health and the environment. The "no action" alternative (Alternative 1) does not meet this threshold criteria for several reasons. First, without the continued operation of the Ground Water Containment System, the discharge of contamination into Little Elk Creek would resume at the Plant Area. This would cause the water in Little Elk Creek to exceed Federal AWQC for consumption of fish and drinking water. Second, the contamination seeping into the Creek could also impact residential wells located near the Creek. Finally, if the former Plant Area land was used in accordance with its residential zoning designation, unacceptable risks to children and adults would remain from the potential for direct contact with the soil and from exposure to the ground water either while drinking, showering or both.[9] Because Alternative 1 does not satisfy the threshold criterion of protectiveness, it will not be considered further in this analysis.

Each of the other four alternatives (Alternatives 2, 3, 4, and 5) meet this criteria. The on-going operation of the existing Ground Water Containment System, a common element of all four, would continue to capture contamination migrating in ground water from the shallow soils before it enters Little Elk Creek, allowing the Creek to meet Federal AWQC for consumption of fish and drinking water and protecting residents from potential impacts to residential wells near the Creek. EPA has evaluated the small levels of contaminants coming from the air stripper at the treatment plant and has found that they do not pose an unacceptable risk to human health. Each of the remaining alternatives also contains a provision for a protective cover to prevent direct contact with contaminated soil. In addition, institutional controls would be implemented to prevent activities that would adversely affect the cover system or other component of the remedy, or which would result in unacceptable exposure risks related to contaminated soil and ground water. Such institutional controls include land use restrictions within the OU 1 area to prohibit construction, or other activities that could compromise the integrity of the cover system, and prevent exposure to contaminated ground water.

[9]Note that the Baseline Risk Assessment was based on the presence of the existing Ground Water Containment System. If no action is taken at this Site, then seeps and air releases would occur that would increase the risk presented here.

Alternatives 3 and 5 offer the highest degree of overall protection of human health and the environment, because the engineered cap provides an additional barrier to minimize direct contact with contaminated soil and would assist the Ground Water Containment System in preventing unacceptable levels of contamination in the Creek.

Compliance with ARARs

This criterion addresses whether a remedy will meet all of the applicable or relevant and appropriate requirements ("ARARs") of federal and state environmental and facility siting laws and/or will provide grounds for invoking a waiver.

Any cleanup alternative selected by EPA must comply with all applicable or relevant and appropriate federal and state environmental requirements or, under certain conditions, waive one or more ARARs. Applicable requirements are those substantive environmental standards, requirements, criteria, or limitations promulgated under federal or state law that are legally applicable to the Remedial Action to be implemented at a site. Relevant and appropriate requirements, while not being directly applicable, address problems or situations sufficiently similar to those encountered at a site such that their use is well-suited to the particular site. EPA is not waiving any ARARs for Operable Unit 1 of this Site.

Alternatives 2, 3, 4, and 5 meet this threshold criteria. Some of the major ARARs for the Site include:

1. State and Federal water discharge and air emissions standards and requirements - In each alternative, the Ground Water Treatment System would meet (as it has been doing) requirements for how clean the water must be before it can be discharged to Little Elk Creek. The treatment system would also meet (as it has been doing) air emissions requirements for the air stripper, which is the last operation in the treatment system. The SVE system in Alternative 5 would meet air emissions requirements through the use of a treatment system (such as the use of activated charcoal) to treat the contaminated air, prior to emission.

2. Maryland State Water Quality Standards ("SWQS") - The State of Maryland has set various chemical-specific water quality standards, based on the intended use of the particular water body. The State's designated use of this part of Little Elk Creek is "Use I" for fish consumption and general recreation. These SWQS are considered "applicable" for Little Elk Creek. However, due to the close proximity of residential wells along Little Elk Creek, the Federal Ambient Water Quality Criteria ("AWQC") for consumption of fish and drinking water will be considered "relevant and appropriate" for Little Elk Creek. Note that since the start of operation of the Ground Water Containment System, the Creek contaminant levels have dropped significantly. Just beyond the end of the containment system (see Figure 2), the level of contamination generally meets, except for one contaminant, the Federal AWQC for the consumption of fish and drinking water.

3. National Historic Preservation Act - This Act may apply to the Spectron Site due to the 100-year long industrial history of the paper mill which existed prior to the construction of the Galaxy plant. In addition, the Spectron Site is located within Little Elk Creek

Historic District which is listed on the National Register of Historic Places. Based on the Site's history and location in a Historic District, a Determination of Eligibility ("DOE") has been requested by Maryland Division of Historical and Cultural Programs. If cultural resources are found within the OU 1 area that are on or eligible for the National Register of Historic Places, and such cultural resources would be adversely affected by the cleanup, then mitigation activities may be required. These activities could include such things as detailed documentation of cultural resources before any impact by the clean-up.

4. State/Federal floodplain requirements – Since most, if not all, of the Site is within the 100-year floodplain, an evaluation of the impacts to the floodplain would be conducted in each alternative as part of the soil cover or cap design. Any cap or soil cover would be designed in such a way as to minimize impacts, such as impacts to the homes across the Creek from the Plant Area.

5. Resource Conservation and Recovery Act ("RCRA") Hazardous Waste Disposal Regulations - Hazardous waste in the form of DNAPL may be recovered from the Ground Water Treatment System or monitoring wells and then temporarily stored on-site until it can be properly disposed of off-site. Therefore, in regard to the handling and disposal of hazardous waste on-site, these regulations will be considered applicable.

6. Ground water regulations - Maximum Contaminant Levels ("MCLs") and non-zero Maximum Contaminant Level Goals ("MCLGs') - The ground water at the Site is a Class IIA aquifer (i.e., the aquifer system is a current source of drinking water). Therefore, the NCP states that EPA's goal would be to return the ground water to its beneficial use by considering MCLs or non-zero MCLGs as ARARs. However, the NCP does provide certain instances where ARARs may be waived. Sections 300.430(f)(1)(ii)(C)(1-6) of the NCP outline six different ARAR waivers, including the technical impracticability waiver, which may be invoked if compliance with an ARAR is technically impracticable from an engineering perspective.

   Section 300.430(f)(5)(iii)(A) of the NCP states that performance (for example, area of attainment of ARARs) shall be measured at appropriate locations in the ground water, surface water, etc. The preamble to the NCP explains that for ground water, remediation levels should generally be attained throughout the contaminant plume or at and beyond the edge of the waste management area when waste is left in place (55 Fed. Reg. 8753, March 8, 1990). Based on the unique variation of waste located in the Plant Area, EPA has identified that area as a "waste management area." The waste includes residual waste from the former lagoon, contaminated creek sediments from the construction of the Ground Water Containment System, debris pile wastes from historic dredging of the lagoon, structural debris and historic concrete structural foundations with depths of 5 to 10 feet, abandoned drainage pipes, and an abandoned mill race. Because of the existence of these wastes and the complicating presence of residual DNAPL in the overburden soils, ARARs would not need to be attained beneath the Plant Area for Alternatives 2, 3 and 5, where the waste and DNAPL would be contained and maintained by the implementation of the selected OU 1 remedy.

Therefore, an ARAR waiver would be unnecessary for Alternatives 2, 3, and 5, and ARARs would be anticipated to be attained outside the Plant Area perimeter. Figure 7 shows the boundary of the "waste management area" (the area to be contained in each of the Alternatives 2, 3 and 5) located within the area defined by OU 1. Some additional monitoring wells may be necessary to monitor the area of attainment outside the Plant Area perimeter.

A complete list of ARARs for the selected remedy for OU 1 at the Site is presented in Table 9.

Long-term Effectiveness and Permanence

This criterion considers the ability of an alternative to maintain protection of human health and the environment over time. The evaluation takes into account the residual risk remaining from untreated waste at the conclusion of remedial activities, as well as the adequacy and reliability of containment systems and institutional controls.

Alternatives 2, 3, 4, and 5 similarly provide long-term effectiveness in that, for each alternative, the ground water containment, collection, and treatment system will continue to be operated and maintained. The system also provides for natural flushing of contaminants from the soil in the form of rainwater infiltration through a soil cover, as in Alternatives 2 and 4, and ground water cross flow as in Alternatives 2, 3, 4 and 5. In fact, it is essential to the long-term effectiveness of Alternatives 2, 3, 4, and 5 that the containment system be operated and maintained to prevent ground water contamination from seeping into Little Elk Creek. Based on how the system performed during Hurricanes Dennis and Floyd, the system can withstand an extreme storm event. However, maintenance activities for both the liner and the treatment plant must continue to ensure the that the system operates as planned into the future. Due to the presence of DNAPL at the Site and the stringent Federal AWQCs for the consumption of fish and drinking water discussed above, EPA does not anticipate a time when the system can be turned off.

Alternatives 3, 4, and 5 offer the highest degree of contaminant reduction. Alternative 2 provides only minimal treatment through phytoremediation and natural flushing of contaminants into the treatment system. Under Alternative 4, contaminated soil would be excavated only down to the water table, which would fail to treat residual DNAPL at or below the low-permeability layer just below the water table. Alternatives 3 and 5 also offer a low-permeability engineered cover system which would provide a physical barrier between the surface and the occasional high water table. The low-permeability cover and passive venting system would also control chemical vapors that might rise to the surface. In addition, the cover system in Alternatives 3 and 5 would minimize rainwater infiltration, thereby helping to ensure that the treatment plant maintains capacity over the long-term.

EPA believes that Alternative 3 offers the greatest degree of long-term effectiveness and permanence, since the electron donor injection treatment will remove more contaminants than any of the other alternatives. Alternative 2 relies only on natural flushing from rainwater infiltration and ground water cross flow to the existing Ground Water Containment System. Alternative 4, excavation of the contaminated soils down to the water table, provides some short-term protection from direct contact threats, however, the contamination left behind could migrate back to the surface with a rising water table. Alternative 4's excavation work would not reach contamination that will be treated by Alternative 3 and 5's mass reduction methods. The SVE system in Alternative 5 would not be effective, due to numerous subsurface building foundations and old drainage piping from both the paper mill and the recycling plant. The foundations and the piping would limit the effectiveness of the SVE air flows by providing “short-cuts” around contaminated soil.

Reduction of Toxicity, Mobility or Volume of Contaminants through Treatment

This evaluation criterion addresses the statutory preference for selecting remedial actions that employ treatment technologies that permanently and significantly reduce the toxicity, mobility, or volume of the hazardous substances as their principal element. This preference is satisfied when treatment is used to reduce the principal threats at a site.

Alternatives 2, 3, 4, and 5 all utilize the existing natural ground water flushing that washes the contaminants from the shallow soil into the Ground Water Containment System for treatment. The technology used at the treatment plant (biodegradation with an air stripping finishing step) destroys most of the contaminants and leaves a non-hazardous sludge that must be disposed of. However, natural flushing alone is not an effective method to properly treat the principal threat waste, which exists in the shallow soil as residual DNAPL.

Alternative 2 includes phytoremediation, which would degrade some contaminants taken-up by the trees or degraded near the roots. However, the trees would also transfer a small amount of contaminants to the atmosphere with no treatment, and the trees would only transpire during the growing season.

Alternative 3 includes *in-situ* treatment through the injection of an electron donor material to enhance biodegradation within the overburden, above and below the low permeability layer. This alternative would achieve a much greater degree of contaminant removal than would take place with the naturally occurring ground water cross flow flushing, by destroying a significant amount of contamination *in-situ*, in addition to what will be flushed to the ground water treatment plant. This alternative would, therefore, significantly reduce the amount of waste that could potentially mobilize, should the containment system fail.

Alternative 4 includes off-site treatment to destroy the contaminants in the excavated soil. However, since the alternative only provides for excavation of contaminated soil above the water table, it would not provide for treatment of principal threat wastes that would be treated by Alternatives 3 or 5.

Alternative 5 includes soil vapor extraction which would transfer contamination from soil and some ground water to an air stream where it would be treated. This type of treatment would allow some escape of contaminants to the atmosphere. In addition, there would be treatment residuals such as spent carbon, which would need regeneration, or combustion products, if some type of oxidation technology were used. Due to the presence of numerous building foundations, this technology would not be able to treat the volume of contamination that Alternative 3 would.

Short-term Effectiveness

This evaluation criterion addresses the effects of the alternative, during the construction and implementation phase until remedial action objectives are met. It considers risk to the community and on-site workers and available mitigation measures, as well as the time frame for the attainment of the response objectives.

Since the Ground Water Containment System has already been constructed, the adverse effects of each alternative have been minimized other than for Alternative 4, which involves excavation and off-site disposal. Alternative 4 has the greatest potential to cause air releases of contaminants since it involves digging, loading, and transporting of soil. The excavation work would last for approximately 6 months and could be accomplished within an enclosure to minimize potential air releases. However, there would be increased truck traffic through the local community during the construction period, and also the risk that these trucks could spill contaminated soil during transportation.

For Alternatives 2, 3, 4, and 5, construction of the soil cover or engineered cap would involve the delivery of a significant amount of soil, which creates risks due to traffic. Impacts would be minimized by avoiding the narrow steep hill on Providence Road, and through the use of flag persons and a zero-tolerance policy on speeding by trucks. These measures were successfully used during the Ground Water Containment System construction. The use of erosion control measures in each of the alternatives would minimize the potential for any release of contaminated soil to Little Elk Creek during construction.

Alternatives 3 and 5 would not disturb soil below the surface, thus greatly minimizing the chance for uncontrolled air releases. However, there is a slight chance for an air release of dust and contamination when the stock-piled soil is graded (one of the common elements), but this would be monitored and controlled. Dust would also have to be controlled during building demolition.

Alternative 5 utilizes a vacuum extraction method that brings the contaminants to the surface in a vapor form for treatment. While the system in Alterative 5 would be designed to minimize the chance of leaks or escaping vapors, there may still be an accidental release. It is estimated that the soil vapor extraction treatment process would remain on-site for five to ten years.

Implementability

The evaluation of alternatives under this criterion considers the technical and administrative feasibility of implementing an alternative and the availability of services and materials required during implementation.

Each of the alternatives is implementable and the services and materials required for each alternative are readily available. However, some would be more difficult to implement than others.

The foundations from the former paper mill and the solvent recycling plant present obstacles for each alternative. The more an alternative requires subsurface work, the more the foundations cause implementability problems for that alternative. Planting of trees (Alternative 2), installation of injection points for the subsurface treatment (Alternative 3), excavation of soil (Alternative 4), and installation of SVE wells (Alternative 5) are all made more difficult because of the foundations. However, the foundations present the fewest problems for Alternative 3, because Alternative 3 involves the least amount of subsurface disturbance. Also, the location of the injection points (or other delivery system) could easily be adjusted to minimize interferences caused by the foundations.

Alternative 4, which includes soil excavation, would be the most difficult to implement since it may require such preventative measures as a negative pressure tent to assure that no vapors would escape while the excavation was taking place.

Each of the alternatives involves work near a small intermittent stream, which runs parallel to Ed Moore Road before crossing the Site near the Dam. Some environmental restoration work may be required at this stream at the completion of work.

Each of the alternatives requires construction within a floodplain, which presents several difficulties. First, steps must be taken during construction to make sure that, for example, soil is not washed downstream if an extreme storm event occurs during construction. Second, due to the floodplain regulations, the cap or cover design would have to minimize and/or mitigate the effects to the floodplain caused by raising the elevation of the Plant Area. Such steps could include gradual grading along the Creek bank.

Cost

Alternative 3 is the most cost effective alternative. Several points stand out when evaluating the costs. First, the on-going operation of the Ground Water Containment System ranges from 40 - 70% of the cost of each alternative 2, 3, 4, and 5. Second, Alternative 3 offers subsurface treatment of principal threat waste, but at a relatively low cost compared to SVE in Alternative 5. Third, Alternative 3, while at relatively the same cost as Alternative 2, provides effective subsurface treatment with the added protection of a low-permeability engineered cover.

The Alternative Cost Summary Table (see Table 10) summarizes the capital, annual operation and maintenance ("O&M"), and total present worth costs for each alternative. The total present worth is based on an O&M time period of 30 years for the engineered cover system and the Ground Water Containment System. The soil vapor extraction system includes an O&M period of 10 years of SVE operation. A discount rate of 5% was used on the present worth calculation. For an additional cost estimate breakdown, see the Administrative Record.

State Acceptance

The Maryland Department of the Environment ("MDE") has reviewed comments from the public, and after providing comments on this Record of Decision, MDE maintains a preference for Alternative 3 as the selected remedy.

MDE has expressed that if principal threat wastes remain on-site as part of the remedy, such contamination needs to be treated or contained. MDE does not believe that a soil cover will provide adequate direct contact protection to its citizens that may visit the Site. The State believes that a RCRA modified cap: 1) provides an additional barrier to prevent direct contact; and 2) minimizes infiltration that could overwhelm the ground water treatment plant. MDE has also stated that the ground water treatment plant clearly lacks capacity based on continued use of flow equalization tanks for the plant. Therefore, the remedial design shall evaluate whether an increase in the plant capacity is necessary. In regard to Alternative 2, which uses phytoremediation, MDE expressed concerns about the ability of the poplar trees: 1) to effectively treat the Site contamination, especially with the amount of subsurface contamination present; and 2) to consistently reduce the water load to the ground water treatment plant since the trees only actively transpire for about half the year. Thus, Alternative 2 was not preferable to MDE.

Community Acceptance

The local community has not commented specifically about the preferred alternative, but generally has stated its concern for the safety of its drinking water, a quick cleanup of the Site, and a future Site use that may benefit the community. Another issue raised by the community involves the removal of the upstream dam to allow fish passage. This last issue is outside the scope of this operable unit. A summary of comments by the public can be found in the Responsiveness Summary Section of this ROD.

Comments received during the public comment period from the PRPs performing the response actions, are also summarized in the Responsiveness Summary. The PRPs' most significant concerns were: 1) the potential for the enhanced subsurface treatment to adversely impact the ground water collection and treatment system; 2) that treatability tests have not been conducted to determine the efficacy of the enhanced subsurface treatment; and 3) that it would be detrimental to the overall containment system to minimize rain water infiltration with a low-permeability cap.

EPA has responded to the PRPs' concerns about the treatment adversely impacting the ground water containment and treatment system, by including the requirement to phase in the implementation of the enhanced subsurface treatment. The other concerns are addressed in detail in the Responsiveness Summary. EPA believes the selected remedy addresses many of the issues raised by the local community. The selected remedy helps protect drinking water, provides flexibility for future use, and can be implemented in less time than the other alternatives.

11.0 SELECTED REMEDY

Following review and consideration of the information in the Administrative Record, the requirements of CERCLA and the NCP, and public comment, EPA has selected Alternative 3 (In-Situ Treatment with Engineered Cover System and Institutional Controls), as the remedy for OU 1 at the Spectron Site.

11.1 Summary of the Rationale for the Selected Remedy

Alternative 3 will provide permanent and substantial risk reduction through a combination of (1) treatment to address principal threat waste and to minimize potential problems, in the event of a failure of the containment system, (2) engineering controls to prevent contaminant migration and minimize direct contact threats, and (3) institutional controls to prevent activities that would adversely affect the OU 1 remedial action or which would result in unacceptable exposure risks to human health.

In-situ reductive dechlorination via electron donor material is a proven technology which is capable of destroying significant amounts of contamination *in-situ,* thus accelerating the removal of DNAPL, which is a principal threat waste at this Site. Alternative 3 will mitigate releases of hazardous substances to ground water, minimize contaminant mass that may be released due to containment failures, prevent exposure to contamination in the soil and ground water, and protect Little Elk Creek from contaminant releases.

Based on the information available at this time, EPA has determined that, among those remedial alternatives that are protective of human health and the environment and comply with ARARs, the selected remedy provides the best balance of tradeoffs among the balancing criteria (long-term effectiveness and permanence; reduction in toxicity, mobility, or volume through treatment; short-term effectiveness; implementability; and cost) while considering State and community acceptance. Compared to the other alternatives (excluding the "no action" alternative which does not meet the threshold criteria), the selected remedy offers the greatest degree of both long-term protectiveness and permanence and reduction in toxicity, mobility, or volume through treatment by providing the greatest degree of DNAPL removal through the use of an enhanced *in-situ* reductive dechlorination process. The selected remedy also ranks near the highest in terms of short-term effectiveness since it involves no excavation or off-site disposal, and the *in-situ* reductive dechlorination process is the most readily implementable treatment technology of the alternatives considered. In addition, the selected remedy is one of the least costly alternatives and has the concurrence of the State.

Because Alternative 3 will treat source materials which constitute a principal threat, EPA's selection of this alternative also meets the statutory preference for the selection of a remedy that involves treatment as a principal element.

11.2 Description of the Selected Remedy and Performance Standards

The selected remedy utilizes the existing Ground Water Containment System, but adds an impervious protective cover (i.e., a modified RCRA cap) over the contaminated overburden soil with enhanced subsurface treatment of contaminants. The old industrial buildings and structures will be demolished. The Plant Area will be re-graded and then capped with the impervious protective cover, followed by a soil cover which will then be seeded. Operation and maintenance of the Ground Water Containment System components shall continue to assure that contaminants do not bypass the treatment system at any point. Institutional controls will be implemented in order to ensure the effectiveness of the remedial action. The selected remedy shall meet all applicable or relevant and appropriate requirements contained in the attached Table 9.

11.2.1 Containment, Collection, and Treatment of Contaminated Ground Water

Ground water beneath the Plant Area shall be contained, collected and treated on-site, by using or modifying the existing Ground Water Containment System to achieve the following performance standards. The Ground Water Containment System consists of three main components (see Figure 7): 1) ground water treatment plant; 2) Creek liner and cut-off walls to provide containment, and an impervious protective cover to prevent direct contact and excessive rainwater infiltration; and 3) collection drainage ways, piping, and associated pumping equipment. Except for the protective cover, these components are already in operation at the Site. The treated ground water shall continue to be discharged to Little Elk Creek.

Performance Standards for Ground Water Treatment Plant

1. Collected ground water shall be treated, prior to discharge to Little Elk Creek, to comply with the substantive requirements of the National Pollutant Discharge Elimination System ("NPDES") program and the Maryland discharge limitations and monitoring requirements (100 ppb total VOCs, see MDE letter September 3, 1998).

2. Any air emissions shall meet the substantive requirements of Maryland general emission standards, Maryland regulations governing toxic air pollutants and federal air emission standards for process vents. In addition, the emissions shall not exceed risk based standards of 1×10^{-6} carcinogenic risks and Hazard Index of 1 for non-carcinogenic risks. The EPA guidance document, Control of Air Emissions from Superfund Air Strippers at Superfund Ground Water Sites (*OSWER Directive 9355.0-28*, June 15, 1989) shall also be considered in determining the need for air emission controls.

3. A capacity evaluation shall be completed during the remedial design to determine if additional treatment capacity is required. The evaluation shall consider the volume of ground water currently being collected, and the volume, with a safety factor, that could reasonably be assumed to be collected during a wet weather year. The evaluation shall be documented and submitted to EPA in a report. Based on the capacity evaluation report, which shall be updated every two years, EPA will determine if expansion is necessary to prevent untreated ground water from bypassing the containment system.

4. Plant components shall be maintained, and replaced as necessary, to minimize downtime and equipment leaks, and to maximize treatment performance, especially in the powdered activated carbon tanks.

5. Monitoring reports shall be submitted to EPA at such frequency and in such detail to allow EPA to determine whether or not the ground water treatment plant is in compliance with this ROD and, in particular, whether the performance standards one through four above, have been achieved and are being maintained.

6. On site handling of hazardous waste and solid waste, resulting from the operation of the Ground Water Treatment Plant, shall be in accordance with ARARs. Off site disposal and handling shall be in accordance with State and Federal waste regulations. Waste streams may be characterized on a yearly basis, unless regulations require more frequent characterization.

7. An emergency notification plan shall be developed and followed during the remedial

design to inform or alert EPA and MDE of possible shut downs or failures that may impact nearby residents or the environment.

Performance Standards for Creek Liner, Creek Cut-Off Walls, and Impervious Protective Cover

1. Federal Ambient Water Quality Standards for consumption of fish and drinking water, and those other standards listed in Table 11[10, 11] shall be met in Little Elk Creek. This shall be achieved by continued maintenance, and modifications as necessary, of the ground water containment system.

2. Routine sampling shall be performed within the Creek immediately downstream of the Ground Water Containment System for the volatile organic compounds ("VOCs") and semi-VOCs listed in Table 11. Detections of VOCs which exceed the standards set forth in Table 11 could indicate a bypass or failure of the Ground Water Containment System which would require correction.

3. The collection system shall be operated in such a manner as to prevent flotation of the stream liner.

4. A vegetative cover shall be maintained for the area surrounding the Ground Water Containment System within and along Little Elk Creek. The purpose of a vegetative cover is to provide stream bank stabilization and habitat cover. A evaluation report, on the adequacy of the vegetative cover, shall be developed and submitted to EPA every two (2) years following the issuance of the ROD.

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[10]The contaminants for which EPA is setting criteria in this Performance Standard are generally the contaminants of concern ("COCs") for the overburden ground water.

[11]As discussed in the ARARs section of this Record of Decision and in the attached Table 9 and Table 11, Little Elk Creek has been designated by the State of Maryland "Use I" for fish consumption and general recreation, however, EPA considers the Federal AWQC for consumption of fish and drinking water "relevant and appropriate" for the selected remedy due to the close proximity of residential wells along Little Elk Creek, downstream of the Site. Therefore, the criteria listed in this performance standard are, unless otherwise noted, AWQCs for the consumption of fish and drinking water. For those compounds which are COCs in the overburden ground water, but which do not have AWQCs for the consumption of fish and drinking water, the value listed is either the level in drinking water that results in a Hazard Index of 1.0, the level in drinking water that results in a carcinogenic risk of 1×10^{-6}, a Maryland State Water Quality Standard for protection of drinking water (if available), or the AWQC for the protection of aquatic life (Freshwater Criterion Continuous Concentration). For several compounds, the AWQC for the protection of aquatic life was used instead of the AWQC for the consumption of fish and drinking water since the latter did not provide for the protection of aquatic life.

5. The Creek containment system shall be maintained such that fish can travel up to the dam.

11.2.2 Demolition and Site Grading

The demolition, to grade, of all structures on the Plant Area (see Figure 2), except the ground water treatment plant. The demolition is required to: 1) enable proper installation of the RCRA modified cap and to ensure its integrity; and 2) remove the potential hazard posed to people by the unsound Power House building, which is in danger of collapse. Grading across the Plant Area shall promote drainage of rainwater. The use of stockpiled soil, building debris that meets COMAR 26.04.07.04C(5), and the debris pile will minimize the need for clean-fill during preparation of the sub-base.

Performance Standards for Demolition and Site Grading

1. Demolish buildings, tank foundations, and other existing structures except those related to the ground water treatment plant. Demolition plans for any historic structures shall be developed in accordance with the National Historic Preservation Act of 1966, as amended.

2. Prepare the sub-base for the RCRA modified cap:

    a. Stockpiled soils; building demolition debris; and debris piles removed from the area above the upper dam shall be graded as part of the sub-base.

    b. Grading shall be performed to provide a sub-base to the cap and to divert water off of the cap.

    c. The graded sub-base soils shall not contain stones or construction debris that could cause a puncture in the cap.

3. Any DNAPL discovered during grading activities shall be collected and managed on-site in compliance with substantive requirements of regulations applicable to generators of hazardous waste; and treated and/or disposed of off-site at a RCRA hazardous waste facility, in compliance with the permitting and other requirements of RCRA and the State of Maryland hazardous waste regulations.

4. Air emissions during Site grading activities shall comply with the substantive requirements of Maryland emission standards and Maryland regulations governing toxic air pollutants.

5. All excavation activities that will affect wetlands, floodplains, or waters of the United States shall be conducted in accordance with the substantive requirements of Federal Regulation of Activities in or Affecting Wetlands/Floodplains, 40 C.F.R. Sections 6.302(a) and (b), and Maryland Water Management: Construction on Non-tidal Waters and Floodplains regulations.

11.2.3 Installation and Maintenance of a Modified RCRA Cap

The installation of a RCRA modified cap shall take place across the Plant Area as identified in Figure 7. The purpose of the cap is to prevent direct contact with contaminated soils and ground water, which would result in unacceptable exposure risks, and to divert rainwater infiltration, which would hinder the capacity of the Ground Water Containment System. Final grading shall promote drainage off of the Site, and provide a vegetative cover to prevent erosion.

Performance Standards for Modified RCRA Cap

1. A low-permeability cover (cap), with a permeability of 1×10^{-7} cm/sec or less, shall be installed over the sub-base soils. The cap shall have at least two layers of low-permeability material, one of which shall be a geosynthetic membrane.

2. The cap shall be installed such that it completely covers the Plant Area (see Figure 7 for the approximate area of this cap).

3. The cap shall be designed and constructed: to function with minimum maintenance; to promote drainage and minimize erosion or abrasion of the cover; to accommodate settling so that the cover's integrity is maintained; and to provide adequate freeze protection for the liner material.

4. The cap shall be designed and constructed to accommodate access to monitoring wells and *in-situ* injection points and associated piping.

5. The cap shall be vegetated and maintained in such a way as to prevent erosion of soils above the liner material. However, vegetation shall be such that root systems do not damage the liner material by extending down into the liner material. The types of vegetation shall be identified in the remedial design. The remedial design shall be submitted to EPA and the State for review and approval by EPA.

6. The cap design shall be designed to permit gas venting. Presently, it is not known whether VOC emissions beneath the cap would exceed levels that require control under Federal and State regulations. Field data would be collected in order to assess air emissions, and controls would be implemented as necessary to comply with the Federal and State ARARs identified in this ROD.

11.2.4 In-Situ Reductive Dechlorination of Contaminants

Electron donor materials and other amendments shall be added to the contaminated overburden ground water in order to reduce the contaminant mass to the maximum extent practicable. The electron donor material shall be applied at points above and below the low permeability layer across the entire Plant Area, to promote distribution of electron donor material and to accelerate the intrinsic biodegradation of ground water contaminants which has been observed at the Site. The biodegradation process will result in final mineralization products of the contaminants of concern such as carbon dioxide, water, chloride ion, ethane and ethene. Amendments (e.g. inorganic nutrients, organic carbon, peat humic substances, treatment plant discharge water and/or other microbes) may be added to stimulate or augment existing microbial populations, so that they can more aggressively break down the chemicals of concern in ground water. Treatment shall be conducted in such a manner as to not adversely impact the ground water collection and treatment system.

Performance Standards for In-Situ Reductive Dechlorination of Contaminants

1. Conduct bench-scale treatability studies to determine the type of electron donor material that best promotes biodegradation of the Site contaminants using a reductive dechlorination process. Bench-scale treatability studies shall also evaluate use of amendments (e.g. inorganic nutrients, organic carbon, peat humic substances, treatment plant discharge water and/or other microbes) to augment the use of the electron donor material. The selection of electron donor materials and amendments shall be subject to approval by EPA.

2. Bench-scale treatability studies shall be designed to help evaluate microbial production of dissolution material such as iron or "bio-mass."

3. Prior to any addition of treatment materials on Site, baseline concentrations of the final mineralization products of the contaminants of concern shall be determined. The report summarizing these baseline concentrations shall be subject to EPA acceptance. These results will be used to evaluate future treatments.

4. A field-scale pilot study shall be conducted to develop parameters for the full-scale operation of the reductive dechlorination treatment process in such a manner as to not adversely impact the operation of the ground water collection and treatment system. The field-scale study shall cover between 10 and 33% of the Plant Area. During this study, monitoring shall be conducted to measure the following: the distribution and performance of the electron donor material and any amendments, biological activity, decreases of parent products, increases of daughter products, dissolved iron levels, oxygen levels, water levels and any bio-mass accumulations. In addition, the ground water treatment plant influent shall be monitored for changes which may occur as a result of the field-scale pilot study. After one year of treatment, a report summarizing the field-scale pilot study and providing recommendations for full-scale implementation across the Site shall be provided to EPA for review and approval. Upon approval by EPA, treatment shall begin across the entire Site (see Figure 7).

5. Electron donor materials and other amendments shall be added to provide sustained significant increases above the baseline concentrations of the final mineralization products of the ground water contaminants, both above and below the low permeability layer. Performance evaluations of the treatment process shall continue once treatment has been initiated site wide. Contaminant levels, levels of daughter products, and levels of mineralization products (such as ethane and ethene) shall be sampled and evaluated and shall continue for five years from the initiation of site wide treatment. After this five year period, a study shall be conducted to evaluate concentration levels of the final mineralization products of the contaminants of concern, as well as trends in these levels over the five year study period. As long as the concentrations are significantly above the

baseline, as determined by EPA, active support of the treatment shall continue.

6. The design shall provide for injection of electron donor material upgradient, (i.e., along the retaining wall) to take advantage of the cross-site flow of ground water toward Little Elk Creek. The application method for the electron donor material (such as direct push technology, permanent injection wells, continuous drips, etc.) shall be determined during the remedial design phase.

7. In addition to monitoring performance of the reductive dechlorination treatment process, data from the overburden ground water zone of the Plant Area shall be collected to determine if the treatment is adversely impacting the ground water collection and treatment system. A plan for monitoring impacts to the Groundwater Collection and Treatment System shall be developed during the remedial design.

11.2.5 Performance Standards for Institutional Controls

A Land Use Control Assurance Plan ("LUCAP") shall be developed to address institutional controls, including land use restrictions, for the Site. The institutional controls contained in this ROD are based on current, reasonably anticipated uses of the Site and area in the vicinity of the Site, but could change in the future if such uses change. The purpose of the LUCAP shall be to prevent exposure to unacceptable risks associated with remaining Site-related contaminants and to protect the components of the selected remedy. A status report on such institutional controls shall be prepared and submitted for EPA's review every two (2) years, at minimum, following the issuance of the ROD.

Protect integrity of the cap in the Plant Area

1. Provide and maintain a protective cover over OU 1 area soils and ground water

   The integrity of the cap shall not be disturbed. There shall be no activity or property use within the Plant Area that could compromise the integrity of the cap, including construction of below-grade foundations or footers, borings, well installation, or placement of heavy equipment, trailers, or other similar activities, without EPA's prior determination that such use could not compromise the integrity of the cap. Institutional controls, such as land use restrictions, shall be implemented to accomplish this.

2. Prohibition of Ground water Exposure in OU 1 Area

   Use and/or contact with overburden ground water within the OU 1 Area, via ingestion, vapor inhalation or dermal contact, is prohibited to avoid unacceptable exposure to contaminants in ground water. Institutional controls shall be implemented to accomplish this.

3. Prohibition on Interference with the Ground Water Containment System

Any activity that could interfere with the operation of the Ground Water Containment System, such as excavation and/or construction within the portion of Little Elk Creek that flows through the OU 1 Area (see Figure 7), is prohibited. Institutional controls shall be implemented to accomplish this.

4. Protection of In Situ Biodegradation System in Plant Area and Surrounding Area

In the land area identified in Figure 10, (which includes the Plant Area and the hillside above the Plant Area) there shall be no activity that could interfere with the in-situ treatment component of the remedy, including:

(1) activities that could change the natural cross-flow of ground water into the Plant Area, depicted in Figure 3, without EPA's prior acceptance. Installation of new wells on properties adjacent to the Plant Area, and significant increases in the pumping rates of existing wells adjacent to the Plant Area; and similar activities, are prohibited.

(2) activities that could interfere with the points of application/injection within the Plant Area.

11.3 Summary of the Estimated Remedy Costs

The estimated present worth cost of the selected remedy is $9,492,014. This figure includes the costs presented in the detailed cost summary in Table 10a.

The information in this cost estimate summary table is based on the best available information regarding the anticipated scope of the response action. This is an order-of-magnitude engineering cost estimate that is expected to be within +50 to -30 percent of the actual project cost. Changes in the cost elements are likely to occur as a result of new information and data collected during the engineering design of the remedial alternative. Minor changes may be documented in the form of a memorandum in the Administrative Record. Changes which are significant, but not fundamental, may be documented in an Explanation of Significant Differences. Any fundamental changes would be documented in a ROD amendment.

11.4 Expected Outcomes of the Selected Remedy

This section presents the expected outcomes of the selected remedy, In-Situ Treatment with Engineered Cover and Institutional Controls, in terms of resulting land and ground water uses and risk reduction achieved as a result of the response action.

The continued operation of the Ground Water Containment System will keep the Creek within the Federal Ambient Water Quality Standards for fishing, and recreational use. The ecological habitat and fish passage that have been developed in the Creek will continue to be maintained as a natural environmental setting which benefits people and wildlife.

The *in-situ* reductive dechlorination process will accelerate the degradation of the mass of contamination such that there would be a reduced impact to the Creek, should the Creek containment system fail.

The Site itself will be mostly open space with a park-like setting. However, if the local community so chooses, it may allow development of the Site in a manner consistent with the land use restrictions identified above. Site visitors and workers could enter the Site knowing that there is a protective cap or barrier between them and the contamination below. The plastic layer will provide a clear separation between clean cover soil above and contaminated soil below, and will be beneficial in the event of storm erosion or flood wash-outs.

Institutional controls will restrict residential development and any use of ground water within the Plant Area of the Site, and activities which could interfere with the protective barrier cap, operation of the Ground Water Containment System, and the *in-situ* treatment portions of the remedy.

12.0 STATUTORY DETERMINATIONS

Under CERCLA, selected remedies must protect human health and the environment, comply with ARARs, be cost-effective and use permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable. Additionally, CERCLA includes a preference for remedies that use treatment to significantly and permanently reduce the volume, toxicity or mobility of hazardous wastes, as their principal element. The following sections discuss how the selected remedy for OU 1 at the Spectron Site meets these statutory requirements.

12.1 Protection of Human Health and the Environment

The selected remedy will protect human health and the environment by providing for the continued operation and maintenance of the Ground Water Containment System. This system will minimize releases of contaminated ground water and, through maintenance of the liner will protect ecological habitat and fish passage in Little Elk Creek. A multi-layer cap will provide protection against direct contact with contaminated soils for industrial/construction workers or other visitors to the plant.

The *in-situ* treatment of shallow soil and ground water will accelerate contaminant mass reductions such that possible releases of contamination to the Creek will be minimized if the containment system should fail.

Exposure to soil and ground water will be prevented by restricting residential use of the Plant Area.

Air emissions from the existing air stripper are below existing regulatory levels and shall be maintained that way. Treated ground water, which is discharged to Little Elk Creek, will meet all appropriate water quality standards and NPDES limitations in order to prevent any adverse human health and environmental effects.

12.2 Compliance with Applicable or Relevant and Appropriate Requirements

The selected remedy will attain all applicable or relevant and appropriate requirements, which are identified as a performance standard in Section 11.2 and specified in Table 9 of this ROD.

12.3 Cost-Effectiveness

The selected remedy is cost-effective in that it eliminates or mitigates the risks posed by the contaminants at the Site, meets all requirements of CERCLA and the NCP, and its overall effectiveness in meeting the remedial action objectives is proportional to its cost. In fact, the selected remedy is nearly the lowest cost (see Table 10), yet ranks the highest or near highest in terms of long-term effectiveness and permanence; reduction in toxicity, mobility or volume; and short-term effectiveness, compared to the other alternatives.

12.4 Utilization of Permanent Solutions and Alternative Treatment Technologies to the Maximum Extent Practicable

The selected remedy utilizes long term solutions and treatment technologies to the maximum extent practicable through the use of containment, collection, and treatment of contaminants of concern from soil, the use of natural cross-site flushing to move contaminants into the Ground Water Containment System, and the use of *in-situ* reductive dechlorination processes to reduce, through degradation, contaminants from shallow soil and ground water. The selected remedy provides for much more effective treatment of contaminants to reduce the mobility, toxicity and volume of the principal threat waste compared to using Alternative 2's phytoremediation, at about the same overall cost, or at one third less the cost of Alternative 5's soil vapor extraction. The selected remedy would have significantly less impact to the community during installation and operation of *in-situ* treatment as compared to Alternative 4, which uses soil excavation and trucks, or Alternative 5, which uses soil vapor extraction. Of those alternatives that are protective of human health and the environment and comply with ARARs, EPA has determined that the selected remedy provides the best balance of tradeoffs, in terms of long-term effectiveness and permanence, reduction in toxicity, mobility, or volume through treatment, short-term effectiveness, implementability, and cost, while also considering the statutory preference for treatment as a principal element, and State and community acceptance.

12.5 Preference for Treatment as a Principal Element

The selected remedy will meet the statutory preference for treatment as a principal element, since it treats the principal threat waste present at the Site. This is done through a combination of *in-situ* treatment of overburden soil which contains principal threat wastes and natural cross-site ground water flushing to the Ground Water Containment System.

12.6 Five-Year Review Requirements

Because the remedy will result in hazardous substances remaining on-site above levels that will allow for unlimited use and unrestricted exposure, a review will be conducted at least every five years after initiation of the remedial action, pursuant to CERCLA Section 121(c) and the NCP, 40 C.F.R. Section 300.430(f)(5)(iii)(C), in order to ensure that the remedy continues to provide adequate protection of human health and the environment.

13.0 DOCUMENTATION OF SIGNIFICANT CHANGES

There have been no significant or fundamental changes to the proposed remedy as a result of public comments. However, during the public comment period, some suggestions by the public enhanced the selected remedy and were therefore added to the Record of Decision. These include the following:

1. Due to concerns expressed about the potential negative impacts of Alternative 3, "In-Situ Treatment with Engineered Cover System and Institutional Controls," upon the ground water collection and treatment system, the selected remedy includes the addition of a field-scale pilot study to ensure that the treatment is implemented in such a fashion as to not adversely impact the ground water collection and treatment system.

2. Due to concerns expressed about the ability to measure a 70% mass reduction of contamination as a result of the *in-situ* treatment component of the remedy, the Remedial Action Objective has been changed from a 70% mass reduction, to a measure of the concentration of the final mineralization products of the ground water contaminants. The underlying goal of both these measures is the reduction of DNAPL to the maximum extent practicable.[12] The *in-situ* treatment shall continue and shall be evaluated every five years, until EPA determines that the active support of the *in-situ* treatment is no longer contributing to significant reductions in contamination.

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[12]Note that this is consistent with EPA's policy for addressing DNAPLs as sources of contamination [40 C.F.R. Section 300.430(a)(1)(iii)(A) and *Presumptive Response Strategy* EPA 540/R-96/023, OCT 96].

III. RESPONSIVENESS SUMMARY

Spectron, Inc. Site
OPERABLE UNIT 1

ELKTON, CECIL COUNTY, MARYLAND

RESPONSIVENESS SUMMARY

This Responsiveness Summary documents public participation in the remedy selection process for Operable Unit 1 ("OU 1") of the Spectron, Inc. Superfund Site. It contains a summary of the major comments received by EPA during the public comment period on the Proposed Remedial Action Plan ("Proposed Plan") for OU 1 at the Site and EPA's responses to those comments.

I. Summary of Significant Comments from June 26, 2003 Public Meeting and EPA Responses

EPA held a public meeting near the Site on June 26, 2003 to accept public comment on EPA's Proposed Plan for OU 1. The significant comments received regarding the plan are summarized here, along with EPA's responses thereto. Because this Responsiveness Summary is a statutorily required document designed to meet the legal requirement that EPA summarize and respond to significant comments received regarding the Proposed Plan, EPA will provide a brief overview of the comments related to the OU 1 remedy issues and the Agency's response. The entire transcript of the meeting, including all comments received on any topic and EPA's response, is included in the publicly available portion of the Administrative Record for anyone who wants to view them.

A. Concerns Raised Regarding the OU1 Remedy

Commentors at the public meeting requested a description of the *in-situ* treatment material and degradation process. One commentor asked why Oxidation Pyrolysis ("OP") was not considered a technology to treat contaminants.

EPA's Response to Comment: The type of electron donor material that will be used for the *in-situ* treatment will be selected during bench-scale treatability studies based on the ability to promote biodegradation of the Site contaminants. The material may be as simple as molasses, or as complex as a commercial product with patented time release capabilities to allow for fewer injections. The injection material may also contain other amendments (e.g. inorganic nutrients, organic carbon, peat humic substances, treatment plant discharge water and/or other microbes) to enhance the degradation process of the contaminants. The type and quantity of these amendments also will be determined during the treatability and bench top studies. The bacteria in this reductive dechlorination process work best in an anaerobic environment. During the degradation process, contaminants may first degrade to more toxic materials such as vinyl chloride, before degrading to less toxic materials such as ethene and ethane. Any degraded contaminants will eventually move into the Ground Water Containment System and the Ground Water Treatment Plant, and will be collected and treated there.

The Oxidation Pyrolysis treatment method was not directly considered for mass removal, however, a comparable treatment method using vapor extraction and in-situ oxidation was considered in the selection process. The reasons for not selecting those technologies are the same for not choosing OP: cost, short circuiting of treatment, and possible adverse impacts to the Ground Water Treatment System ("GWTS"), such as destruction of the bacteria currently used in the treatment plant.

B. Comments surrounding the integrity of the engineered cap and the stream liner

During the public meeting, questions arose as to the durability of the engineered cap that is to be installed over the plant area, and the longevity of the existing containment system which is located in the Creek. One commentor asked if the cap was a permanent solution.

EPA's Response to Comment: The Ground Water Containment System, which includes the stream liner and the cap, is viewed as a permanent solution. The life expectancy of the impervious plastic material that will be part of the RCRA modified cap, which is the same material used in the existing stream liner, is greater than 30 years if it remains covered with soil or stone. The material is strong and durable, however, if the plastic material is exposed to sunlight or ozone, its life expectancy could decrease. The stream liner, which is part of the existing containment system, remained in place during Hurricane Floyd, although much of the vegetation that was newly planted before the storm was lost. The remedy selected in the OU 1 ROD requires repairs, maintenance and replacement, as necessary, for any and all components of the Ground Water Containment System.

C. Comments surrounding the maintenance and operation of the Ground Water Treatment Plant

During the public meeting, concerns were raised as to the possible operational problems of the treatment plant during electrical outages.

EPA's Response to Comment: The ground water treatment plant has operated for four (4) years. During that time, occasional regional power outages have caused the system to shut down temporarily. Because the system is designed to capture excess flow during temporary shut downs, there have been no increases in water levels, which could lead to liner damage, and no discharges of untreated water as a result of the shut downs.

D. Comments regarding Natural Resource Trustees.

During the public meeting, a citizen asked whether a natural resource damage assessment had been conducted and whether the Natural Resource Trustees had been notified.

EPA's Response to Comment: The National Oceanographic and Atmospheric Administration ("NOAA") and the Department of Interior ("DOI") are Natural Resource Trustees that have been involved at the Site since the original design of the Ground Water Containment System. Both NOAA and DOI have been advised about the Proposed Plan and the preferred alternative identified for OU 1. The Trustees have informally assessed conditions at the Site in the past, but a final natural resource damage assessment will not be conducted until the construction for all phases of the remedial action for the Site are complete.

E. Comments regarding future use of the Site property.

During the public meeting, concerns were raised about the future use of the Site. One commentor asked if the property could be used for a public park; another commentor stated that they would like to see the dam removed.

EPA's Response to Comment: Since property use is generally a local matter, a number of uses for the Site may be appropriate so long as the use is protective of the federal remedy and will not result in unacceptable exposure risks. The future use of the Plant Area portion of the Site, covered by this OU1, will be limited by restrictions that are necessary to protect the engineered protective cover component of the remedy, and to prevent exposure to the underlying soil and ground water contamination in the overburden there. These restrictions will prevent any construction that could compromise the integrity of the cap and/or result in unacceptable exposure risks from contaminated soil and shallow ground water beneath the Plant Area, such as construction involving below-grade foundations, borings or well installation. Any construction on the Plant Area will require EPA's approval of design plans. In addition, the one acre area around the Ground Water Treatment Plant building will remain restricted and fenced off.

Although the current zoning for this Site property is residential, land use restrictions prohibiting activities that could compromise the integrity of the cap, including construction of below-grade foundations or footers, borings, well installation, placement of heavy equipment or trailers, and other similar activities, and ground water use restrictions prohibiting use and or contact with the over burden ground water, would have to be complied with in order to protect public health.

The removal of the dam to enhance fish passage is not within EPA's authority under CERCLA, since it does not directly impact the protectiveness of the remedy.

F. Comments regarding funding of OU 1.

During the public meeting, concerns were raised as to how the construction work for this phase would be funded.

EPA's Response to Comment: The potentially responsible parties ("PRPs") have financed site-related cleanup costs, to date, under agreements executed with EPA Region III. Under CERCLA Section 122, 42 U.S.C. § 9622, if EPA believes that the use of "special notice" procedures would facilitate an agreement between EPA and PRPs for performance of certain response actions, EPA may offer PRPs the opportunity to negotiate an agreement to undertake those actions, and the Agency may not itself undertake the response actions during the negotiations moratorium. EPA intends to use the CERCLA "special notice" procedures with the PRP group at the Spectron Site, for the OU1 remedial design and remedial action, and anticipates that the PRPs will agree to finance those response actions.

II. Summary of Significant Comments from Potential Responsible Parties ("PRPs")

The exact text of the PRPs' comments, submitted to EPA in a letter dated August 20, 2003, can be found in the administrative record. For convenience, EPA has either summarized or excerpted, in quotes, the substance of the PRPs' significant comments followed by EPA's complete responses, below.

A. PRP Group's General Comments

1. General Comment Re: DNAPL presence and proposed treatment as Principal Threat

"The data presented . . . provide no substantial evidence to support EPA's conclusion that DNAPL source areas in the overburden soil and ground water were identified . . . Because possible residual DNAPL in the overburden, if present, cannot be identified, treatment of DNAPL areas as contemplated in the PRAP is not feasible, practicable or required . . . [R]esidual DNAPL has been confirmed to be present at only a single boring location within OU-1."

EPA's Response to PRPs' General Comment 1: EPA disagrees. The Remedial Investigation ("RI"), as approved in March 2003, provided a sufficient basis to determine that residual DNAPL exists in the shallow Site soils and is acting as a principal threat to ground water. The data from the RI report was used to develop the approved Baseline Risk Assessment (dated April 30, 2003). The approved Baseline Risk Assessment established areas in Operable Unit 1 with a total cancer risk of 1×10^{-3} or a Hazard Index (per target organ) of 100. In addition, the Supplemental Remedial Investigation ("SRI"), which was conducted voluntarily by the PRPs, also identified areas across OU 1 which exceeded a cancer risk of 1×10^{-3} or a Hazard Index of 100. (See SRI data tables). Despite the fact that only two *soil* samples have been found with residual DNAPL, the presence of dissolved phase contaminants found in ground water evidences the presence of residual DNAPL in the overburden throughout the Plant Area. The concept of "principal threat" material is defined, in EPA guidance (*A Guide to Principal Threat and Low Level Threat Wastes*, Superfund Pub. 9380.3-06FS, November 1991) and the National Contingency Plan ("NCP"), 40 C.F.R. 300.430(a)(1)(iii), as a "source material that contains contaminants that act as a reservoir for migration of contamination to groundwater, surface water, air or act as a source for direct exposure." During the RI, shallow soils below the water table were identified which contained visible residual DNAPL (for example, see soil sample B-1, PZ-19). The residual DNAPL in soil acts as a source material by continually dissolving contaminants into the groundwater and, therefore, is considered a principal threat. Both the RI and the SRI revealed dissolved phase contaminants in ground water that indicate the existence of residual DNAPL in soil that is the principal threat (see EPA memorandums dated November 8, 2002 and July 17, 2002 which EPA provided to the PRPs in October 2003).

2. General Comments Re: Issue of Principal Threat

a. “. . .[T]he RI, FS and RA did not provide any investigation or evaluation of principal threat material and as such provide no basis for the development of a remedial alternative for addressing principal threat material.”

b. “On January 10, 2002, the PRP Group submitted a written proposal to the EPA for the supplemental RI task. The PRP Group did not receive a written response . . . .”

c. “On October 31, 2002, representatives from the PRP Group, EPA and MDE met at EPA Region III offices to discuss the finalization of the draft RI/FS/RA. In that meeting, the EPA’s Remedial Project Manager (“RPM”) and risk assessor stated that principal threat soils for the site would be defined as ‘soils that pose a cancer risk of 1.0 x 10^{-3} or higher and have an HI of 100 or greater for direct contact.’”

d. “. . . EPA finalized the OU1 RI, RA and FS without incorporating these data [from the Supplemental Remedial Investigation submitted to EPA dated June 25, 2003] . . . The NCP requires that ‘site specific data needs, the evaluation of alternatives and the documentation of the selected remedy should reflect the scope and complexity of the site problems to be addressed.’ Therefore, the PRAP is technically flawed and inconsistent with the NCP process.”

EPA’s Response to PRPs’ General Comment 2a: The basic goal of both the RI and Risk Assessment (“RA”) is to identify the levels and extent of site contamination and to determine the risk posed by such contamination. The goal of the FS is to develop and evaluate options for remedial action, based on an analysis of data collected during the RI. The determination of whether or not a principal threat risk exists, as defined in the NCP and EPA guidance documents (see EPA’s Response to PRPs’ General Comment 1, above), is based on data contained in the Administrative Record, including data from the RI and the RA. The FS did consider various options for treatment of source material, which included the principal threat wastes.

EPA’s Response to PRPs’ General Comment 2b: No written response was required for the PRP Group proposal, dated January 10, 2002, since EPA determined that additional sampling from a supplemental RI task, would not be necessary. EPA’s determination, which was based on RI data that the Agency viewed as sufficient, identified areas of principal threat material (see EPA guidance 9380.3-06FS, November 1991), and was provided to the PRP Group during the meeting of December 19, 2001. Despite EPA’s determination that additional sampling was unnecessary, the PRP Group chose to conduct the SRI. The data provided to EPA from the sampling confirmed the findings of the RI. While this data will be useful during the remedial design, it was not needed to confirm the existence of principal threat waste or to evaluate alternatives as described in the Proposed Plan.

EPA's Response to PRPs' General Comment 2c: EPA agrees that it defined principal threat as soils with cancer risk of $1x10^{-3}$. The PRPs suggest that since only one *soil* sample had DNAPL that it is insufficient evidence of DNAPL throughout the Site. It is EPA's position that the presence of dissolved phase contamination in ground water (at levels of $1x10^{-3}$ cancer risk or greater) indicates the presence of principal threat soils.

EPA's Response to PRPs' General Comment 2d: EPA did finalize the OU 1 RI, RA and FS without incorporating the SRI data, because EPA had enough information to prepare the Proposed Plan and to select the preferred remedial alternative. In November 2002, as pointed out by the PRPs' comment, EPA advised the PRPs that the Agency did not believe the SRI was necessary. EPA received the completed SRI in June 2003, after the Proposed Plan was issued. However, EPA reviewed the SRI data and considered it in selecting the remedy for OU 1 and in preparing the OU 1 ROD. The data in the SRI supported EPA's determination that principal threat material is present throughout the Plant Area – based on the presence of dissolved phase contaminants in ground water in addition to the residual DNAPL found in certain samples – and is consistent with the information upon which EPA selected the preferred alternative in the Proposed Plan. The SRI has been included in the Administrative Record. See EPA's Response to PRPs' General Comments 1 and 2c, above. Had the SRI contained new information that would have significantly changed the basic features of the remedy in terms of scope, performance or cost, EPA would be required by the NCP to either identify such changes to the remedy or to revise and reissue the Proposed Plan for an additional public comment period. See 40 C.F.R. Section 300.430(f)(2).

3. General Comments Re: Flushing of VOCs/Mass Removal of Current System

a. **"Given the mass removal benefit of infiltration and the demonstrated performance of the Stream Isolation/Ground Water Collection and Treatment system, as acknowledged by EPA in the PRAP document, eliminating infiltration is not an appropriate objective for the remedy."**

b. **"There is no substantial evidence to support EPA's position that in-situ treatment is appropriate at this site. . . . The PRP Group views EPA's plans to inject treatment chemicals into**

the subsurface without first conducting treatability studies to be arbitrary and contrary to generally accepted scientific and industry practices, with the potential for severe adverse consequences."

c. **"The Ground Water Containment, Collection, and Treatment System is a complicated system in design and operation . . . The Treatment System was designed based on the influent characterization developed during design studies. The system was not designed to handle treatment solutions of any kind that would be injected into the subsurface and flow into the collection system . . . [t]he collection system pipes cannot be cleaned or replaced should they become clogged or fouled with biomass."**

EPA's Response to PRPs' General Comment 3a: The Plant Area, defined in the OU 1 ROD, currently is covered entirely with an asphalt cap, which the Maryland Department of the Environment ("MDE") ordered owner Paul Mraz to install in 1982. This existing cap has minimized rainwater infiltration to the area. Therefore, the demonstrated success of the ground water containment, collection, and treatment system ("Ground Water Containment System") is attributable primarily to the ground water cross flow at the Site, which is running within the overburden from the hills toward Little Elk Creek, as theorized by both the PRPs and EPA. EPA described this "cross flow" in the Proposed Plan as enabling contaminants to flush toward the Ground Water Containment System. It is this ground water "cross flow" that will be used to distribute the in-situ treatment material. Because infiltration to the area already has been minimized by the existing asphalt cap, mass removal will not be impaired by the addition of the engineered cover system component of the selected remedy.

In addition, EPA believes that the Ground Water Containment System is operating near or above design capacity, based on recent reports and discussions with the PRP Group (see memo dated July 11, 2003), which indicate high sump levels and increased flow equalization capacity from 30,000 gallons to 90,000 gallons over time. A soil cover, as suggested by PRPs' comment and recommended in the FS, would damage the existing asphalt and allow additional infiltration to enter an already overloaded system. The installation of the engineered cover system component of the selected remedy will reduce the amount of infiltration and provide a reliable means to control infiltration over the long term. EPA also is concerned that the highly oxygenated rain water would enter the collection system and cause additional bio-mass fouling; bio-mass fouling has already occurred as a result of the oxygen added by the sump pump to the discharge piping.

EPA's Response to PRPs' General Comment 3b: EPA is not required to select a remedy based on a "substantial evidence" standard, but is required to determine whether the preferred alternative is the most appropriate action based on specific balancing criteria and taking into consideration comments from the public. (See NCP at 40 C.F.R. § 300.430(f)). EPA in part based its decision to use in-situ reductive dechlorination at the Site on the Feasibility Study Report Addendum for OU 1. The FS Report Addendum included a proposal, identified as Alternative 10, to address highly contaminated soils by using electron donor material in localized "hot spot" treatment areas. However, EPA expanded the treatment method identified in Alternative 10 to cover broader areas which have been identified as principal threat areas, recognizing that a targeted "hot spot" treatment approach would not be possible without installing a multitude of additional borings, due to the unpredictable sub-surface conditions in the Plant Area. Despite the broader treatment area, this approach is still cost effective because it injects treatment material into the existing ground water cross Site flow. EPA's determination that this form of treatment is appropriate for the conditions and contaminants identified at the Site is further supported by EPA personnel experienced with in-situ treatment using reductive dechlorination (e.g., electron donors) materials, and is documented in the Administrative Record.

The Proposed Plan did require treatability studies to determine the appropriate type of electron donor material, contrary to the PRPs' assertion. However, in response to the PRPs' concern, EPA additionally has clarified, in the stated objectives for the in-situ reductive dechlorination component of the OU1 ROD, that treatment shall be conducted in such a manner as to not adversely impact the ground water collection and treatment system (see ROD Section 9.2, Description of Alternative 3). The ROD further adds the requirement for conducting pilot and bench scale studies, to be performed during the remedial design under the selected OU1 remedy. Although treatability studies have not yet been conducted at the Site, the reductive dechlorination technology has been employed successfully at sites with similar conditions. (See Documents re: Rocky Mountain Arsenal Site, in the Administrative Record). Based on comments received during the public comment period, EPA has modified the selected remedy to include pilot and bench scale studies prior to full scale implementation of the treatment system.

EPA's Response to PRPs' General Comment 3c: EPA shares the PRPs' concern that the treatment must not adversely impact the ground water collection pipes or the treatment plant. A bench scale study will be conducted as part of the OU1 remedy, to identify the types of electron donor materials and amendments that will optimize contaminant mass reduction without adverse impacts to the treatment system, such as development of excess vinyl chloride. This information will then be used in developing operational parameters for the phased start-up of the full scale treatment system.

Although the treatment system may not have been specifically designed with the use of treatment solutions in mind, the plant already uses electron donor material in its daily operation to degrade contaminants. As mentioned previously, studies will be conducted to identify an appropriate electron donor which will optimize contaminant mass reduction without adversely impacting the treatment system. The collection system currently contains clean-out ports to remove biomass buildup if necessary.

4. **General Comment: Risk Assessment Conclusions**

a. "There is no substantial evidence to support EPA's assumption of future residential development at this site. As only industrial activities are anticipated, it is unreasonable to evaluate risks to on-Site residents when addressing risks to future receptors."

b. "The Proposed Plan states that the risk driver for potential residential use is arsenic, which could be due to background conditions. This determination is inconsistent with the remainder of the Proposed Plan, which states that the *Principal Threat* at the site is DNAPLs." (Emphasis in original).

EPA's Response to PRPs' General Comment 4a: The Site property is zoned residential, therefore EPA is required by the NCP to assume future residential development. Moreover, as the PRPs are aware, a family was living on the one-acre Office Area portion of the Site that EPA intends to address under Operable Unit 2, which also is zoned residential.

EPA's Response to PRPs' General Comment 4b: It is not inconsistent for EPA to identify arsenic as a "risk-driver" for potential residential use, and DNAPLs as the "principal threat" material. The terms are different conceptually. The selected remedy will prevent direct contact with both arsenic and DNAPL through installation of the cap.

The concept of "risk driver" results from the risk evaluation process for the Site, taking into account the concentrations and exposure scenarios for different receptors. The Proposed Plan pointed out that arsenic (found in on-Site soils) is a risk-driver for residential receptors, based on exposure to *soil* concentrations on-site. The Proposed Plan's "Summary of Risks Section" also states that for construction and industrial workers, risks were driven by a large suite of volatile organic compounds ("VOCs"), along with a few semi-volatile compounds, pesticides, and possibly arsenic.

There are also risk exceedances for future adult/child residents (see Table 7).

As discussed above, the concept of "principal threat" is used in EPA guidance (*A Guide to Principal Threat and Low Level Threat Wastes*, Superfund Pub. 9380.3-06FS, November 1991) and the National Contingency Plan ("NCP"), 40 C.F.R. 300.430(a)(1)(iii), to characterize "source material that contains contaminants that act as a reservoir for migration of contamination to groundwater, surface water, air or act as a source for direct exposure." The Guidance states that "where toxicity and mobility of source material combine to pose a potential risk of 1×10^{-3} or greater, generally treatment alternatives should be evaluated." The concept of "principal threat" at the Site specifically relates to the source material causing *ground water* contamination.

5. **General Comment: Selection of Biological Subsurface Treatment**

   a. **"If an in-situ mass removal/destruction technology is a component of the OU-1 remedy, the type of treatment and specific technology can only be selected based on appropriately designed bench-scale treatability and pilot studies conducted during Preliminary Remedial Design."**

   b. **"The EPA's ROD for OU-1 should not specify any particular type of technology for in-situ treatment nor should it specify performance criteria without supporting technical information and data that the technology will be successful in achieving the remedial action goals. Alternately, the ROD should be delayed until appropriate studies are conducted."**

EPA's Response to PRPs' General Comment 5a: EPA agrees that bench-scale and field pilot studies will be beneficial to determine the appropriate electron donor and amendments and the rate at which the materials should be added to avoid adverse impacts to the Ground Water Containment System and, therefore, has included in the remedy for OU1 the requirement to conduct such studies during the remedial design. (See also EPA's response to PRP General Comment 3b). However, EPA disagrees that the specific technology can only be selected after such studies are performed. (See EPA's Response to PRPs' General Comment 5b, below).

EPA's Response to PRPs' General Comment 5b: EPA disagrees with the comment that the ROD should not specify any particular type of technology for in-situ treatment. EPA's decision to use an electron donor in-situ treatment method was based on similarly contaminated sites that have successfully treated contamination. EPA included in the Proposed

Plan the requirement for treatability studies, to determine the type and amount of electron donor material to be used at the Spectron Site. The ROD adds the requirement for conducting bench scale and pilot studies and a phased approach to further evaluate and apply the electron donor material in the proper dose. With regard to performance criteria, the ROD modifies the method identified in the Proposed Plan in that the ROD will measure the effectiveness of the in situ treatment by the amount of daughter products of mineralization generated over time (see also EPA's Response to PRPs' General Comment 3b).

K. PRP Group's Specific Comments

1. PRPs' specific comments regarding EPA's proposed Remedial Action Objectives ("RAOs"):

a. The PRPs' suggested specific re-wording of EPA's RAOs in the Proposed Plan (see page 12 of the Proposed Plan) related to (1) ensuring continued operation and maintenance of the previously constructed Ground Water Containment System; (2) preventing current or future direct contact with contaminated soils; (3) preventing current or future direct use of contaminated ground water; and (4) treating principal threat wastes.

b. "The term principal threat as defined in the PRAP for OU-1 is inconsistent with the definition set forth by EPA in the October 31, 2002 meeting. The remedial investigation results do not indicate the presence of DNAPL except in one location, the former lagoon area. . . ."

c. "Natural flushing through OU-1 coupled with the Ground Water Containment System is already achieving significant mass removal. Considering that the majority of the contaminant mass is present in the bedrock . . . There are several concerns with the technical objective and practicability of treating principal threat waste to achieve at least a 70% contaminant mass removal. . . ."

d. "The PRAP includes a statement that EPA has determined, based on its experience at other Superfund sites, that a goal of 70% mass removal provides significant environmental benefit to ground water. . . ."

EPA's Response to PRPs' Specific Comment 1a: EPA has carefully considered the wording changes suggested by the PRPs, and has incorporated some of them into the ROD, although the format of the ROD differs from the Proposed Plan. Specifically, with regard to treating principal threat wastes and the suggested changes to the RAO relating to a 70% reduction in contaminant mass, EPA has: (1) changed the performance criteria in the ROD to a measure of the daughter products of mineralization over time; and (2) added to the ROD the requirement for conducting bench scale studies and field pilot studies during the remedial design.

EPA's Response to PRPs' Specific Comment 1b: Based on the high concentrations of VOCs in ground water in the Plant Area, EPA believes that DNAPL is present in soils at the Site. As stated in EPA's Response to PRP General Comment 1, residual DNAPL contamination is bound to the soil matrix and therefore is not mobile, however, the DNAPL continues to slowly dissolve into the ground water over time. Since there is a continued release of contamination from the soil into the ground water over time, the residual DNAPL is considered a source and therefore a principal threat.

EPA's Response to PRPs' Specific Comment 1c: <u>See</u> EPA's Response to PRPs' Specific Comment 1a.

EPA's Response to PRPs' Specific Comment 1d: <u>See</u> EPA's Response to PRPs' Specific Comment 1a.

2. **PRPs' specific comments regarding Alternative 3: In-Situ Treatment with Engineered Cover System and Institutional Controls.**

   a. **The PRPs suggested specific rewording of the Proposed Plan's Alternative 3 with regard to deferring, until the remedial design, a decision on: (1) the type of engineered cover to be used; and (2) the method and technology for the subsurface treatment.**

<u>Engineered Cover System</u>

   b. **"None of the RAOs state that infiltration is to be reduced. The engineered cover system specified in the Proposed Plan is therefore not necessary. . . ."**

   c. **"The eastern third of the site needs to remain asphalt in order to provide access to the ground water treatment building, so constructing an engineered cover system is not practical in that area. . . ."**

<u>Anaerobic Bioremediation</u>

d. **"The PRAP indicates that anaerobic bioremediation will treat DNAPL contamination. Anaerobic bioremediation will not directly treat any DNAPL that may exist. . . ."**

EPA's Response to PRPs' Specific Comment 2a: EPA has evaluated the use of soil covers and, based on the capacity of the ground water treatment plant, concerns about direct contact with principal threat material, ARAR requirements for maintaining waste in place, and the State of Maryland's general preference for a low permeability protective cover, EPA has determined that a RCRA modified cap is appropriate for the Spectron Site (see also EPA's Response to PRPs' General Comment 3a). In addition, EPA has determined that, based on information from similarly contaminated sites, an in-situ treatment method is practical, cost effective, and meets the NCP requirement that EPA generally shall "use treatment to address the principal threats posed by a site, wherever practicable." 40 C.F.R. Section 300.430(a)(1)(iii).

EPA's Response to PRPs' Specific Comment 2b: Since proper operation and maintenance of the Ground Water Containment System was a RAO in the Proposed Plan, the engineered cover system is warranted. The Ground Water Containment System is currently operating near maximum capacity during wet weather events. Reduction of rain water infiltration to the over burden is inherent to the proper operation and maintenance of the system. The existing asphalt cap minimizes rainwater infiltration but has cracks and does not cover the entire area, therefore, exposure to contaminated soils remains an issue. The PRPs' proposed soil cap would involve removing parts of the asphalt parking lot and would increase infiltration, thereby potentially increasing the burden on the Ground Water Containment System.

EPA's Response to PRPs' Specific Comment 2c: The eastern third of the Site, which contains the existing ground water treatment plant, was specifically designed with an elevated profile to allow for installation of a cap. An asphalt cover could be installed over the cap to allow service vehicles to drive on the cap without damaging it.

EPA's Response to PRPs' Specific Comment 2d: EPA is aware that DNAPL cannot be *directly* treated by biodegradation, however, the biodegradation can continue in the areas where dissolved-phase constituents have been found in ground water. By reducing the concentration of dissolved phase constituents in the ground water, additional DNAPL can be dissolved, thereby reducing – and treating – the overall mass of DNAPL.

3. **PRPs' specific comments suggesting rewording of language in the Proposed Plan to: "OU-1 includes the soil beneath the Spectron Plant**

Area and shallow *(overburden)* ground water (ground water above the bedrock) ***beneath the Plant Area, including overburden ground water captured in the Stream Isolation/Ground Water Collection and Treatment System (SI/GWCTS)."***

EPA's Response to PRPs' Specific Comment 3: EPA agrees with the PRPs' suggested insertion of the word "overburden" to describe the soil above bedrock, and has used this description in the ROD. However, any ground water located in the overburden, whether it originated in overburden hills above the Site or from the bedrock below the Site, will be considered part of OU1. EPA prefers the name "Groundwater Containment Collection and Treatment System" to be the appropriate name for the system, rather than the PRPs' nomenclature – which suggests that the purpose of the system is to isolate the stream.

4. **PRPs' specific comments regarding EPA's description, within the Proposed Plan, of the existence of DNAPL above the low-permeability silt layer at the Site; and that "[t]he potential mobilization of any DNAPL during in-situ treatment . . . is counter to the stated remedial objectives and precepts of the NCP regarding principal threat material."**

EPA's Response to PRPs' Specific Comment 4: The DNAPL located above the low-permeability zone is a residual DNAPL. This DNAPL, while highly concentrated, adheres to the soil and will resist moving downward with gravity. In addition, there is already DNAPL below the low permeability layer and even deeper within the bedrock fractures. Based on the RI data and boring logs, EPA believes that any mobile DNAPL above the low-permeability layer has already migrated downward via pathways such as foundations, loose fill material, and drainage ways installed by prior property owners and operators. The in-situ treatment component of EPA's selected remedy is consistent with the NCP's expectation that EPA will use treatment to address the principal threats posed by a site wherever practicable (40 C.F.R. Section 300.430(a)(1)(iii)(A)), as described in the OU 1 ROD. However, any treatment method that would be designed to deliver the electron donor material through the low-permeability layer, would be designed to be self sealing, such that contaminated ground water could not transverse.

5. **PRPs' specific comments suggesting rewording of language within the Proposed Plan to: 'The actions proposed in this Proposed Plan constitute the final actions for the Plant Area soils, stream sediments beneath the liner and shallow ground water above the bedrock (overburden ground water), which include contaminant source areas.'**

EPA's Response to PRPs' Specific Comment 5: The OU1 selected remedy includes the Ground Water Containment, Collection, and Treatment system, as well as the Plant Area soils, stream sediments beneath the liner and overburden groundwater. The OU1 ROD does not refer to the Ground Water Containment, Collection, and Treatment as a contaminant source area.

6. **PRPs' specific comments suggesting rewording of language within the Proposed Plan describing the actions in OU-1 (<u>see</u> PRP Comments, page 16) to:**
"…1) maintain the isolation of Little Elk Creek surface water by the current stream liner and by the operation of the existing treatment system; 2) address principal threat material … in Plant Area shallow soil (soil located from the water table to the top of the bedrock)."

EPA's Response to PRPs' Specific Comment 6: EPA declines to adopt the PRPs' re-wording for (1), which removes the words "prevent ground water contamination from entering Little Elk Creek. . ." and will retain EPA's language to describe the objectives of OU1 as ". . .to 1) prevent ground water contamination from entering Little Elk Creek by using the existing Ground Water Containment System," because EPA's primary objective is to prevent contamination from entering the creek. EPA further declines to adopt the PRPs' suggested re-wording of (2), and will retain EPA's language to "2) address principal threat material . . . in the Plant Area shallow soil (*soil located from the surface to the top of the bedrock*)." (Emphasis added). EPA considers the Plant Area shallow soils to encompass the area between the ground surface and the top of the bedrock surface.

7. **PRPs' specific comments suggesting that EPA strike any description regarding the OU-2 remedy or, in the alternative, that EPA reword the language within the Proposed Plan describing the actions in OU-2 to: "and to address any unacceptable ecological risks that may be found in Little Elk Creek downstream of the containment system that exists today.**"

EPA's Response to PRPs' Specific Comment 7: EPA disagrees that a description of OU-2 should be struck from the Proposed Plan. As a matter of EPA policy and in accordance with EPA's guidance, EPA includes in Proposed Plans and RODs a general description of anticipated future operable units, to provide an overview of the expected scope of the project. EPA agrees with the proposed re-wording, and has added "unacceptable" to better describe the levels of ecological risk.

8. **PRPs' specific comments asserting that "There is no technical basis for the statement that 'EPA has determined that treatment is practicable for the principal treat waste.'"**

EPA's Response to PRPs' Specific Comment 8: Based on evaluations by EPA experts and contractors, of sites where treatment has successfully been employed, and recommendations in the Feasibility Study's Alternative #10, EPA determined that treatment is practicable for the principal threat waste (the residual DNAPL) at the Site. See also, EPA's Response to PRPs' General Comment 3(b) above.

9. **PRPs' specific comment concerning EPA's description of the cap within the Common Elements, suggesting that "the extent of the cover will be determined during the Remedial Design phase. The cover area may or may not be continuous. The cover may also incorporate existing concrete building/containment pads," and that the language should be revised to state that "Demolition is necessary: . . . 2) to enable the installation of a protective cover over the appropriate area(s)."**

EPA's Response to PRPs' Specific Comment 9: The PRPs' comment requests that EPA change the cap component of the OU1 remedy to cover only certain areas as determined during the remedial design. EPA declines to adopt this comment. The RI and SRI data clearly show contamination at concentrations above risk levels throughout the Plant Area, which supports the need for a continuous cap across the entire plant area as described in Figure 7 of the ROD. The design phase will focus on the placement of the perimeter of the cap and how it is to be secured. The selected OU1 ROD remedy component for the cap requires demolition to grade of all structures on the Plant Area, subject to ARARs. See also EPA's Response to PRPs' Specific Comment 2c.

10. **PRPs' specific comment stating "Given the assumed or inferred presence of DNAPL and the residual soil and groundwater concentrations, it is not expected that MCLs will ever be attained beneath the Plant Area; therefore, an ARAR waiver is appropriate for the site."**

EPA's Response to PRPs' Specific Comment 10: EPA agrees that it is unlikely that MCLs will ever be attained beneath the Plant Area within OU 1, and recognizes that an ARAR waiver known as a Technical Impracticality ("TI") waiver could be appropriate for that area (see Figure 7). However, based on the unique variation of wastes that will be consolidated beneath the RCRA modified cap, EPA has identified that area as "a waste management area" for purposes of attaining remediation levels. As stated in the Proposed Plan, the preamble to the NCP provides that remediation levels should be attained at and beyond the edge of the waste management area where waste is left in place. 55 Fed. Reg. 8753 (Mar. 8, 1990). The waste that will be left in place beneath the RCRA modified cap includes residual waste from the former lagoon, contaminated creek sediments from the construction of the Ground Water Containment System, debris pile wastes from historic dredging of the lagoon, anticipated structural debris from the demolition of existing masonry structures, and historic concrete structural foundations with depths of 5 to 10 feet, abandoned drainage pipes and an abandoned mill race. Because of the existence of these wastes and the complicating presence of residual DNAPL in the overburden soils, ARARs would not need to be attained beneath the Plant Area, where the waste and DNAPL will be contained and maintained by the implementation of the selected OU 1 remedy. Therefore, an ARAR waiver is unnecessary for OU-1, and ARARs are anticipated to be attained outside the Plant Area perimeter.

11. **PRPs' specific comments concerning EPA's description, within the Proposed Plan, of the Maryland SWQS ARAR (<u>see</u> page 20 of the Proposed Plan), that: (a) "The statements beginning with 'The slight exceedence…' through the end of the paragraph should be removed from the PRAP, as these statements only speculate on the technical conclusions. . .."; and (b) "The observed liner float was not due to the capacity limitations of the treatment system."**

EPA's Response to PRPs' Specific Comment 11: The Performance Standards for Ground Water Containment System, within the ROD, does not discuss specific underlying reasons for the exceedences of the Federal AWQC, but requires correction, should such exceedences be detected. The ROD does not discuss the reasons for the observed liner float.

12. **PRPs' specific comment citing EPA's observation in the Proposed Plan that there are no MCL or non-zero MCLG accedences in OU-1 beyond the waste management area, and therefore each alternative would meet ARARs, to support the PRPs' argument that "additional mass removal efforts by in-situ injection or other methods would provide no benefit to the protectiveness of the remedy."**

EPA's Response to PRPs' Specific Comment 12: EPA disagrees that additional mass removal efforts would provide no benefit to the protectiveness of the remedy. It is undisputed that high levels of VOC contamination exists within the waste management area, which is the Plant Area. The NCP requires that the remedial action utilize permanent solutions and alternative treatment technologies to the maximum extent practicable; and that for purposes of determining attainment of cleanup standards for waste management areas such as the Plant Area, it is acceptable to measure attainment at or beyond the boundary. See EPA's Response to PRPs' Specific Comment 10. Simply because ARARs are attained outside the waste management area is no justification for not treating the waste management area itself.

13. **PRPs' specific comment that "EPA presents no substantial evidence to support its position that electron donor injection treatment will remove more contaminants than any of the other alternatives. . . [or that] 'significant reduction in mass' on the order of 70% can be achieved. . . [and] the treatment approach contemplated by EPA will increase the mobility of the waste."**

EPA's Response to PRPs' Specific Comment 13: In response to the PRPs' comments concerning support for the selection of the electron donor injection treatment method, and concerning the 70% reduction in contaminant mass, see EPA's Response to PRPs' Specific Comment 1a. The PRPs' assertion that the selected treatment approach will increase the mobility of the waste suggests a concern that the excess waste will impact the treatment system. The performance standard for the In Situ Reductive Dechlorination component of the remedy (see Section 11.2.5 of the ROD) requires that there be no adverse impact to the ground water collection and treatment system. In addition, the ROD requires bench-scale and treatability studies and a phased approach to evaluate whether the treatment adversely impacts the ground water collection and treatment system. [See also, EPA's Response to PRPs' Specific Comment 3a and 3b].

14. **PRPs' specific comment suggesting that EPA reword the summary of EPA's preferred alternative to:**

(a) an *engineered cover* or cap over *certain* plant areas to minimize direct contact with soil;

(b) "*Sub-surface treatment to reduce the mass of VOC contaminants in the ground water zone to the extent technically practicable . . . .*"

(c) "Demolition . . . to allow installation of the *engineered cover as designed*"

(d) "Sampling of the debris pile . . . and possible relocation of the debris pile to the area that will be *covered*"
[Emphasis added].

EPA's Response to PRPs' Specific Comment 14:

(a) EPA's selected remedy includes an engineered cover system over the entire, approximately 3-acre Plant Area, with a goal to minimize direct contact with soil *and* infiltration of rainwater. See EPA's Response to PRPs' General Comment 3a; and EPA's Response to PRPs' Specific Comment 9.

(b) Based on comments by both the PRPs' and EPA's own experts, EPA has modified the performance criteria in the Proposed Plan, of a 70% reduction of contaminant mass, to a measurement in the selected remedy of the reduction in daughter products produced by the biodegradation.

(c) See EPA's Response to PRPs' Specific Comment 9.

(d) See EPA's Response to PRPs' Specific Comment 9.

15. PRPs' specific comment, concerning EPA's wording in the Proposed Plan of Alternative 3, that "[t]he infiltration of rain water does not pose a concern for the capacity of the treatment plant, and the elimination of this infiltration by the engineered cover is not a benefit."

EPA's Response to PRPs' Specific Comment 15: EPA disagrees with the PRPs' comment. See EPA's Response to PRPs' General Comment 3a.

16. PRPs' specific comment concerning the Cost section of the Proposed Plan and the Alternative Cost Summary, that "[t]he PRAP does not provide sufficient information to understand or review the capital and operation & maintenance ("O&M") costs presented. The O&M costs of the existing groundwater collection and treatment system are expected to decrease with time. Further, costs for the in-situ treatment component of the remedy cannot be reasonable quantified."

EPA's Response to PRPs' Specific Comment 16: Table 10a of the ROD provides detailed cost information for the selected remedy. EPA's estimate of future O&M costs conservatively assumes that current O&M costs will remain constant over the 30 year period, however, EPA recognizes that such costs could decrease. EPA's cost estimate for the in-situ treatment component of the selected remedy, as modified from the PRAP, is derived from Alternative 10 of the Feasibility Study submitted by the PRP Group. Those costs also are detailed in Table 10a.

Table 1
Summary of Analytical Results for Plant Area Soil Contaminants of Concern
Galaxy/Spectron Site
Elkton, Maryland

Analyte	Distribution Type	Number of Samples	Max Detect
Volatile Organic Compounds			µg/kg
Tetrachloroethane, 1,1,2,2-	lognormal	19	1.40E+04
Tetrachloroethene	lognormal	19	2.60E+04
Trichloroethene (TCE)	LN	19	5.30E+03
Vinyl Chloride	lognormal	19	1.00E+03
Semivolatile Organic Compounds			µg/kg
Benz(a)anthracene	lognormal	12	1.10E+03
Benzo (a) pyrene	lognormal	12	8.60E+02
Benzo(b)fluoranthene	lognormal	12	1.50E+03
Dibenz(a,h)anthracene	NORMAL	12	2.80E+02
Dichlorobenzene, 1,4-	lognormal	12	4.40E+04
Trichlorobenzene, 1,2,4-	lognormal	12	1.60E+05
Pesticide/PCBs Compounds			µg/kg
Aroclor-1242	lognormal	12	1.60E+03
Inorganics			mg/kg
Aluminum	NORMAL	12	1.88E+04
Antimony	lognormal	12	1.78E+01
Arsenic	lognormal	10	8.56E+01
Barium	lognormal	12	7.44E+02
Cadmium	lognormal	12	8.02E+01
Chromium	lognormal	12	3.42E+02
Iron	lognormal	12	4.79E+04
Lead	lognormal	12	4.31E+03
Manganese	NORMAL	12	3.74E+02
Mercury	lognormal	12	2.80E+00
Nickel	lognormal	12	2.49E+02

Table 2
Summary of Analytical Results for Overburden Ground Water Contaminants of Concern (COC)
Galaxy/Spectron Site
Elkton, Maryland

Analyte	Distribution Type	Number of Samples	Max Detect (µg/L)
Volatile Organic Compounds			
Acetone	lognormal	18	1.20E+05
Benzene	lognormal	27	1.40E+03
Benzyl Chloride	lognormal	7	7.60E+00
Butanone, 2-	lognormal	21	1.90E+04
Chlorobenzene	lognormal	27	2.10E+04
Chloroethane	lognormal	27	4.20E+03
Chloroform	lognormal	27	2.40E+03
Dichloroethane, 1,1-	lognormal	27	3.80E+04
Dichloroethane, 1,2-	lognormal	27	3.60E+04
Dichloroethene, 1,1-	lognormal	27	8.60E+03
Dichloroethene, 1,2- (total)	lognormal	12	5.20E+04
Ethylbenzene	lognormal	27	4.30E+03
Methylene Chloride	lognormal	6	7.40E+05
Methyl-2-Pentanone, 4-	lognormal	27	1.80E+04
Tetrachloroethane, 1,1,2,2-	lognormal	27	1.65E+03
Tetrachloroethene	lognormal	27	2.65E+04
Toluene	lognormal	27	3.60E+04
Trichloroethane, 1,1,1-	lognormal	27	8.30E+04
Trichloroethane, 1,1,2-	lognormal	27	1.80E+02
Trichloroethene	lognormal	27	8.00E+03
Trichloro-1,2,2-trifluoroethane, 1,1,2-	lognormal	4	1.10E+04
Vinyl Chloride	lognormal	27	1.40E+04
Xylene (total)	lognormal	27	1.82E+04
Semivolatile Organic Compounds			
bis (2-Chloroethyl) ether	lognormal	8	2.90E+02
Chloroaniline, 4-	lognormal	8	9.90E+03
Chlorophenol, 2-	lognormal	8	3.40E+01
Dichlorobenzene, 1,2-	lognormal	14	2.50E+04
Dichlorobenzene, 1,3-	lognormal	9	2.70E+01
Dichlorobenzene, 1,4-	lognormal	12	3.30E+03
Methylnaphthalene, 2-	lognormal	8	3.60E+01
Methylphenol, 4-	lognormal	8	8.70E+02
Naphthalene	lognormal	8	2.80E+01
Trichlorobenzene, 1,2,4-	lognormal	8	8.75E+01

Pesticide/PCBs			
BHC, alpha-	NORMAL	8	5.70E-02
BHC, beta-	lognormal	8	2.70E-01
BHC, delta-	lognormal	8	4.40E+00
Dieldrin	NORMAL	8	9.90E-02
Heptachlor epoxide	lognormal	8	2.60E-02
Total Inorganics			
Aluminum	NORMAL	8	1.78E+05
Antimony	lognormal	10	1.42E+02
Arsenic	lognormal	8	5.80E+00
Barium	lognormal	10	1.48E+03
Beryllium		8	1.23E+01
Cadmium	lognormal	10	4.27E+01
Chromium	lognormal	10	3.90E+02
Cobalt	lognormal	8	4.18E+02
Copper	lognormal	10	1.28E+03
Iron	lognormal	15	4.91E+05
Lead	lognormal	9	1.32E+03
Manganese	lognormal	17	1.88E+04
Nickel	lognormal	10	1.03E+03
Vanadium	lognormal	10	4.38E+02
Zinc	lognormal	7	2.88E+03

Table 3 - Analytical Results of Little Elk Creek Contamination

Below is a list of volatile organic compounds found in Little Elk Creek during a February 1998 sampling event not long before construction began on the Creek containment system. The levels listed are some of the highest found during that sampling event. This sampling was conducted as part of removal action to address the Creek contamination. Other contaminants, such as semi-volatile organic compounds, pesticides and metals, were found in the overburden ground water during the Remedial Investigation and may have been in the Creek as well during this sampling event since the overburden ground water discharges to the Creek. Note that this sampling was conducted in the Creek; however, prior to the installation of the Creek liner, seeps of overburden ground water along the Creek bank at the Plant Area contained visible sheens of contamination. Without the continued operation and maintenance of the ground water containment and treatment system, contaminated ground water currently being captured and treated would discharge untreated to the Creek.

Contaminant	Level (μg/L)	Federal Ambient Water Quality Criteria for the Consumption of Fish and Drinking Water (μg/L)
acetone	67	*
benzene	7.6	2.2
chlorobenzene	50	680
chloroform	2.9	5.7
1,1-dichloroethane	3,000	*
1,2-dichloroethane	37	0.38
1,1-dichloroethene	260	*
trans-1,2-dichloroethene	55	0.057
cis-1,2-dichloroethene	3,800	*
ethylbenzene	9.5	3,100
methylene chloride	110	4.6
4-methyl-2-pentanone	5.6	*
1,1,2,2-tetrachloroethane	7.4	0.17
tetrachloroethene	65	0.69
toluene	210	6,800
1,1,1-trichloroethane	1,900	200 (Maryland State Water Quality Standard)

Contaminant	Level (μg/L)	Federal Ambient Water Quality Criteria for the Consumption of Fish and Drinking Water (μg/L)
1,1,2-trichloroethane	1.3	0.59
trichloroethene	160	2.5
vinyl chloride	1,100	2.0

* A standard for this contaminant has not been defined in The FAWQC.

Table 4
Summary of Analytical Results and Exposure Point Concentrations for Plant Area Soils - Galaxy/Spectron Site Spectron Inc. Site - Elkton, Maryland

Analyte	Distribution Type	Number of Samples	Max Detect	Mean	Standard Deviation	UCLn95	UCLt95	Does UCL Exceed Max Detect?	Exposure Point Concentration	Exposure Point Concentration (mg/kg)
Volatile Organic Compounds			µg/kg	µg/kg	µg/kg	µg/kg	µg/kg		µg/kg	
Tetrachloroethane, 1,1,2,2-	lognormal	19	1.40E+04	3.98E+01	1.60E+01		7.41E+04	Yes	1.40E+04	1.40E+01
Tetrachloroethene	lognormal	19	2.60E+04	1.02E+02	2.83E+01		5.37E+06	Yes	2.60E+04	2.60E+01
Trichloroethene (TCE)	LN	19	5.30E+03				3.69E+04	Yes	5.30E+03	5.30E+00
Vinyl Chloride	lognormal	19	1.00E+03	1.88E+01	5.76E+00		4.20E+02	No	4.20E+02	4.20E-01
Semivolatile Organic Compounds			µg/kg	µg/kg	µg/kg	µg/kg	µg/kg		µg/kg	
Benz(a)anthracene	lognormal	12	1.10E+03	1.45E+02	2.38E+00		4.28E+02	No	4.28E+02	4.28E-01
Benzo (a) pyrene	lognormal	12	8.60E+02	1.81E+02	2.06E+00		4.00E+02	No	4.00E+02	4.00E-01
Benzo(b)fluoranthene	lognormal	12	1.50E+03	2.85E+02	2.18E+00		7.02E+02	No	7.02E+02	7.02E-01
Dibenz(a,h)anthracene	NORMAL	12	2.80E+02	1.43E+02	8.03E+01	1.84E+02		No	1.84E+02	1.84E-01
Dichlorobenzene, 1,4-	lognormal	12	4.40E+04	6.91E+02	9.00E+00		2.76E+05	Yes	4.40E+04	4.40E+01
Trichlorobenzene, 1,2,4-	lognormal	12	1.60E+05	1.07E+03	1.24E+01		2.60E+06	Yes	1.60E+05	1.60E+02
Pesticide/PCBs Compounds			µg/kg	µg/kg	µg/kg	µg/kg	µg/kg		µg/kg	
Aroclor-1242	lognormal	12	1.60E+03	1.55E+02	4.46E+00		2.72E+03	Yes	1.60E+03	1.60E+00
Inorganics			mg/kg	mg/kg	mg/kg	mg/kg	mg/kg		mg/kg	
Aluminum	NORMAL	12	1.88E+04	9.50E+03	4.76E+03	1.20E+04		No	1.20E+04	1.20E+04
Antimony	lognormal	12	1.78E+01	3.72E+00	2.42E+00		1.13E+01	No	1.13E+01	1.13E+01
Arsenic	lognormal	10	8.56E+01	8.61E+00	2.89E+00		4.00E+01	No	4.00E+01	4.00E+01
Barium	lognormal	12	7.44E+02	1.22E+02	2.14E+00		2.90E+02	No	2.90E+02	2.90E+02
Cadmium	lognormal	12	8.02E+01	2.26E+00	6.43E+00		1.74E+02	Yes	8.02E+01	8.02E+01
Chromium	lognormal	12	3.42E+02	4.42E+01	2.64E+00		1.64E+02	No	1.64E+02	1.64E+02
Iron	lognormal	12	4.79E+04	1.64E+04	1.77E+00		2.83E+04	No	2.83E+04	2.83E+04
Lead	lognormal	12	4.31E+03	2.28E+02	4.58E+00		4.43E+03	Yes	687.45 avg	687.45 avg
Manganese	NORMAL	12	3.74E+02	2.29E+02	9.57E+01	2.79E+02		No	2.79E+02	2.79E+02
Mercury	lognormal	12	2.80E+00	5.32E-01	3.05E+00		1.30E+00	No	1.30E+00	1.30E+00
Nickel	lognormal	12	2.49E+02	1.98E+01	2.99E+00		1.00E+02	No	1.00E+02	1.00E+02

Table 5
Summary of Analytical Results and Exposure Point Concentrations for Overburden Ground Water
Galaxy/Spectron Site
Elkton, Maryland

Analyte	Distribution Type	Number of Samples	Max Detect (µg/L)	Mean (µg/L)	Standard Deviation (µg/L)	UCLn95 (µg/L)	UCLt95 (µg/L)	Does UCL Exceed Max Detect?	Exposure Point Concentration (µg/L)	Exposure Point Concentration (mg/L)
Volatile Organic Compounds										
Acetone	lognormal	18	1.20E+05	1.26E+02	2.22E+01		1.51E+06	Yes	1.20E+05	1.20E+02
Benzene	lognormal	27	1.40E+03	6.65E+01	1.73E+01		8.36E+04	Yes	1.40E+03	1.40E+00
Benzyl Chloride	lognormal	7	7.60E+00	1.59E+02	6.49E+00		1.15E+05	Yes	7.60E+00	7.60E-03
Butanone, 2-	lognormal	21	1.90E+04	2.46E+02	1.91E+01		8.77E+05	Yes	1.90E+04	1.90E+01
Chlorobenzene	lognormal	27	2.10E+04	1.09E+02	2.64E+01		1.16E+06	Yes	2.10E+04	2.10E+01
Chloroethane	lognormal	27	4.20E+03	9.62E+01	2.46E+01		6.99E+05	Yes	4.20E+03	4.20E+00
Chloroform	lognormal	27	2.40E+03	5.07E+01	2.52E+01		4.58E+05	Yes	2.40E+03	2.40E+00
Dichloroethane, 1,1-	lognormal	27	3.80E+04	4.06E+02	3.04E+01		9.69E+06	Yes	3.80E+04	3.80E+01
Dichloroethane, 1,2-	lognormal	27	3.60E+04	8.74E+01	2.94E+01		1.75E+06	Yes	3.60E+04	3.60E+01
Dichloroethene, 1,1-	lognormal	27	8.60E+03	5.75E+01	1.78E+01		7.89E+04	Yes	8.60E+03	8.60E+00
Dichloroethene, 1,2- (total)	lognormal	12	5.20E+04	1.25E+03	3.51E+01		9.99E+07	Yes	5.20E+04	5.20E+01
Ethylbenzene	lognormal	27	4.30E+03	9.87E+01	1.88E+01		1.78E+05	Yes	4.30E+03	4.30E+00
Methylene Chloride	lognormal	6	7.40E+05	4.33E+02	1.28E+02		1.70E+19	Yes	7.40E+05	7.40E+02
Methyl-2-Pentanone, 4-	lognormal	27	1.80E+04	8.39E+01	1.96E+01		1.84E+05	Yes	1.80E+04	1.80E+01
Tetrachloroethane, 1,1,2,2-	lognormal	27	1.65E+03	5.54E+01	1.98E+01		1.28E+05	Yes	1.65E+03	1.65E+00
Tetrachloroethene	lognormal	27	2.65E+04	1.18E+02	2.51E+01		9.76E+05	Yes	2.65E+04	2.65E+01
Toluene	lognormal	27	3.60E+04	2.37E+02	4.53E+01		6.62E+07	Yes	3.60E+04	3.60E+01
Trichloroethane, 1,1,1-	lognormal	27	8.30E+04	1.08E+03	4.22E+01		1.93E+08	Yes	8.30E+04	8.30E+01
Trichloroethane, 1,1,2-	lognormal	27	1.80E+02	4.86E+01	2.06E+01		1.38E+05	Yes	1.80E+02	1.80E-01
Trichloroethene	lognormal	27	8.00E+03	1.32E+02	2.23E+01		5.67E+05	Yes	8.00E+03	8.00E+00
Trichloro-1,2,2-trifluoroethane, 1,1,2-	lognormal	4	1.10E+04	1.16E+03	6.24E+00		2.03E+09	Yes	1.10E+04	1.10E+01
Vinyl Chloride	lognormal	27	1.40E+04	2.26E+02	2.92E+01		4.35E+06	Yes	1.40E+04	1.40E+01
Xylene (total)	lognormal	27	1.82E+04	2.02E+02	3.22E+01		6.78E+06	Yes	1.82E+04	1.82E+01
Semivolatile Organic Compounds										

Table 5
Summary of Analytical Results and Exposure Point Concentrations for Overburden Ground Water
Galaxy/Spectron Site
Elkton, Maryland

Analyte	Distribution Type	Number of Samples	Max Detect (µg/L)	Mean (µg/L)	Standard Deviation (µg/L)	UCLn95 (µg/L)	UCLt95 (µg/L)	Does UCL Exceed Max Detect?	Exposure Point Concentration (µg/L)	Exposure Point Concentration (mg/L)
bis (2-Chloroethyl) ether	lognormal	8	2.90E+02	3.20E+01	5.30E+00		3.42E+03	Yes	2.90E+02	1.59E-01
Chloroaniline, 4-	lognormal	8	9.90E+03	4.17E+01	1.44E+01		4.76E+06	Yes	9.90E+03	9.90E+00
Chlorophenol, 2-	lognormal	8	3.40E+01	1.72E+01	4.56E+00		8.48E+02	Yes	3.40E+01	3.40E-02
Dichlorobenzene, 1,2-	lognormal	14	2.50E+04	2.46E+02	1.31E+01		2.76E+05	Yes	2.50E+04	2.50E+01
Dichlorobenzene, 1,3-	lognormal	9	2.70E+01	3.96E+01	1.73E+01		4.84E+16	Yes	2.70E+01	2.70E-02
Dichlorobenzene, 1,4-	lognormal	12	3.30E+03	4.34E+01	1.81E+01		3.99E+05	Yes	3.30E+03	3.30E+00
Methylnaphthalene, 2-	lognormal	8	3.60E+01	4.13E+01	4.38E+00		1.67E+03	Yes	3.60E+01	3.60E-02
Methylphenol, 4-	lognormal	8	8.70E+02	3.84E+01	9.38E+00		1.51E+05	Yes	8.70E+02	8.70E-01
Naphthalene	lognormal	8	2.80E+01	4.13E+01	3.37E+00		7.97E+02	Yes	2.80E+01	2.80E-02
Trichlorobenzene, 1,2,4-	lognormal	8	8.75E+01	6.45E+01	2.15E+01	1.01E+02		Yes	8.75E+01	8.75E-02
Pesticide/PCBs										
BHC, alpha-	NORMAL	8	5.70E-02	4.42E-02	3.93E-02	7.05E-02		Yes	5.70E-02	3.70E-05
BHC, beta-	lognormal	8	2.70E-01	4.21E-02	2.60E+00		2.21E-01	No	2.21E-01	1.30E-04
BHC, delta-	lognormal	8	4.40E+00	5.96E-02	6.27E+00		1.65E+01	Yes	4.40E+00	1.26E-03
Dieldrin	NORMAL	8	9.90E-02	5.48E-02	2.94E-02	7.44E-02		No	7.44E-02	7.44E-05
Heptachlor epoxide	lognormal	8	2.60E-02	2.79E-02	2.08E+00		7.88E-02	Yes	2.60E-02	2.60E-05
Total Inorganics										
Aluminum	NORMAL	8	1.78E+05	2.31E+03	2.64E+03	4.24E+03		No	4.24E+03	1.78E+00
Antimony	lognormal	10	1.42E+02	6.90E+00	3.78E+00		3.84E+02	Yes	1.42E+02	1.42E-01
Arsenic	lognormal	8	5.80E+00	4.60E+00	4.09E+00		1.01E+02	Yes	5.80E+00	1.02E-02
Barium	lognormal	10	1.48E+03	2.14E+02	2.68E+00		1.07E+03	No	1.07E+03	8.52E-01
Beryllium		8	1.23E+01	Insufficient Data Set. EPC based on Max Detect.					1.23E+01	3.60E-03
Cadmium	lognormal	10	4.27E+01	1.45E+00	4.36E+00		2.94E+01	No	2.94E+01	2.94E-02
Chromium	lognormal	10	3.90E+02	4.93E+00	5.09E+00		1.43E+02	No	1.43E+02	3.90E-01
Cobalt	lognormal	8	4.18E+02	5.37E+01	4.38E+00		6.49E+05	Yes	4.18E+02	3.19E-01

Table 5
Summary of Analytical Results and Exposure Point Concentrations for Overburden Ground Water
Galaxy/Spectron Site
Elkton, Maryland

Analyte	Distribution Type	Number of Samples	Max Detect (µg/L)	Mean (µg/L)	Standard Deviation (µg/L)	UCLn95 (µg/L)	UCLt95 (µg/L)	Does UCL Exceed Max Detect?	Exposure Point Concentration (µg/L)	Exposure Point Concentration (mg/L)
Copper	lognormal	10	1.28E+03	4.57E+00	2.97E+01		4.17E+11	Yes	1.28E+03	1.28E+00
Iron	lognormal	15	4.91E+05	2.25E+04	1.14E+01		1.22E+07	Yes	4.91E+05	4.91E+02
Lead	lognormal	9	1.32E+03							2.00E-01
Manganese	lognormal	17	1.88E+04	1.57E+03	3.29E+00		7.73E+03	No	7.73E+03	7.73E+00
Nickel	lognormal	10	1.03E+03	1.85E+01	2.60E+00		6.59E+01	No	6.59E+01	6.48E-01
Vanadium	lognormal	10	4.38E+02	1.68E+00	5.16E+00		5.16E+01	No	4.38E+02	4.38E-01
Zinc	lognormal	7	2.88E+03	2.15E+02	1.90E+01		3.01E+08	Yes	2.88E+03	2.40E+00

Table 6
Summary of Toxicity Criteria and Chemical-Specific Parameters Used in the Risk Assessment
Galaxy/Spectron Site
Elkton, Maryland

	RfDo (mg/kg-day)	RfDi (mg/kg-day)	CSFo (kg-day/mg)	CSFi (kg-day/mg)	Oral Absorption	RfDd (mg/kg-day)	CSFd (kg-day/mg)	Volatilization Factor (m^3/kg)	Permeability Coefficient (cm/hr)	Calculation of Soil-to-Air Volatilization Factor*					
										Koc	Di	Dw	H	DA	VF
Volatile Organic Compounds															
Acetone	1.00E-01 I				8.30E-01 N	8.30E-02		1.20E+04	6.00E-04 D				3.88E-05		
Benzene	3.00E-03 E	1.70E-03 E	5.50E-02 I	2.90E-02 I	0.8 RfD/1.0 CSF R/I	2.40E-03	5.50E-02	2.7E+03	2.1E-02 D				5.55E-03		
Benzyl chloride			1.70E-01 I		8.0E-01 R		2.13E-01		1.4E-02 D				3.40E-04		
Butanone, 2-	6.00E-01 I	2.86E-01 I			9.5E-01 N	5.70E-01			1.1E-03 D				4.70E-05		
Chlorobenzene	2.00E-02 I	1.70E-02 E			8.0E-01 R	1.60E-02		6.3E+03	4.1E-02 D				3.70E-03		
Chloroethane	4.00E-01 E	2.90E+00 I	2.90E-03 E		8.0E-01 R	3.20E-01	3.63E-03		8.0E-03 D				1.10E-02		
Chloroform	1.00E-02 I	8.60E-05 E	6.10E-03 I	8.10E-02 I	1.0E+00 N	1.00E-02	6.10E-03	2.9E+03	8.9E-03 D				3.70E-03		
Dichloroethane, 1,1-	1.00E-01 H	1.40E-01 HA			8.0E-01 R	8.00E-02		2.8E+03	8.9E-03 D				5.60E-03		
Dichloroethane, 1,2-	3.00E-02 E	1.40E-03 E	9.10E-02 I	9.10E-02 I	1.0E+00 N	3.00E-02	9.10E-02	4.9E+03	5.3E-03 D				9.80E-04		
Dichloroethene, 1,1-	9.00E-03 I		6.00E-01 I	1.75E-01 I	8.0E-01 R	7.20E-03	7.50E-01	1.4E+03	1.6E-02 D				2.60E-02		
Dichloroethene, 1,2- (total)	9.00E-03 H				1.0E+00 N	9.00E-03		2.9E+03	1.0E-02 D				9.40E-03		
Ethylbenzene	1.00E-01 I	2.90E-01 I		3.85E-03	9.2E-01 N	9.20E-02		4.0E+03	7.4E-02 D				7.90E-03		
Methylene chloride	6.00E-02 I	8.60E-01 H	7.50E-03 I	1.65E-03 I	8.0E-01 R	4.80E-02	9.38E-03	2.4E+03	4.5E-03 D				2.20E-03		
Methyl-2-pentanone, 4-	8.00E-02 H	2.00E-02 HA			8.0E-01 R	6.40E-02			4.00E-03 D				1.40E-04		
Tetrachloroethane, 1,1,2,2-	6.00E-02 E		2.00E-01 I	2.00E-01 I	8.0E-01 R	4.80E-02	2.50E-01	1.2E+04	9.0E-03 D	9.33E+01	7.10E-02	7.90E-06	1.41E-02	7.83E-05	1.25E+04
Tetrachloroethene	1.00E-02 I	1.40E-01 E	5.20E-02 E	1.00E-02 E	1.0E+00 N	1.00E-02	5.20E-02	2.3E+03	4.8E-02 D	1.55E+02	7.20E-02	8.20E-06	7.54E-01	2.40E-03	2.25E+03
Toluene	2.00E-01 I	1.14E-01 I			1.0E+00 N	2.00E-01		3.5E+03	4.5E-02 D				6.60E-03		
Trichloroethane, 1,1,1-	2.80E-01 E	6.30E-01 E			8.0E-01 R	2.24E-01		2.4E+03	1.7E-02 D				1.70E-02		
Trichloroethane, 1,1,2-	4.00E-03 I		5.70E-02 I	5.60E-02 I	8.0E-01 R	3.20E-03	7.13E-02	7.5E+03	8.4E-03 D				9.10E-04		
Trichloroethene	3.00E-04 E	1.00E-02	4.00E-01 E	4.00E-01 E	8.0E-01 R	4.80E-03	1.38E-02	2.6E+03	1.6E-02 D				1.00E-02		
Trichloro-1,2,2-trifluoroethane, 1,1,2-	3.00E+01 I	8.60E+00 H			8.0E-01 R	2.40E+01			1.7E-02 D,3				5.30E-01		
Vinyl Chloride (early life -- *used for resident exposures, assumes lifetime resident*)	3.00E-03 I	2.80E-02 I	1.40E+00 I	3.00E-02 I	1.0E+00 N	3.00E-03	1.40E+00	9.1E+02	7.3E-03 D	1.86E+01	1.06E-01	1.23E-06	1.11E+00	1.45E-02	9.15E+02
Vinyl Chloride (adult -- *used for non-resident exposures*)	3.00E-03 I	2.80E-02 I	7.20E-01 I	1.50E-02 I	1.0E+00 N	3.00E-03	7.20E-01	9.1E+02	7.3E-03 D	1.86E+01	1.06E-01	1.23E-06	1.11E+00	1.45E-02	9.15E+02
Xylenes (total)	2.00E+00 I				9.0E-01 N	1.80E+00		5.7E+03	8.0E-02 D				6.00E-03		
BDCM	2.00E-02 I		6.20E-02 I		1.0E+00	2.00E-02	6.20E-02		5.8E-03				1.60E-03		
Semivolatile Organic Compounds															
Benz(a)anthracene			7.30E-01 E		1.0E+00 3		7.30E-01	8.3E+06	8.10E-01 D	3.98E+05	5.10E-02	9.00E-06	1.37E-04	1.76E-10	8.32E+06
Benzo(a)pyrene			7.30E+00 I	3.10E+00 E	1.0E+00 3		7.30E+00	2.1E+07	1.2E+00 D	1.02E+06	4.30E-02	9.00E-06	4.63E-05	2.64E-11	2.15E+07
Benzo(b)fluoranthene			7.30E-01 E		1.0E+00 3		7.30E-01	4.1E+06	1.2E+00 D	1.23E+06	2.26E-02	5.56E-06	4.55E-03	7.26E-10	4.09E+06
bis(2-Chloroethyl)ether			1.10E+00 I	1.10E+00 I	5.0E-01 R		2.20E+00	1.3E+04	2.1E-03 D				1.80E-05		
Chloroaniline, 4-	4.00E-03 I				5.0E-01 R	2.00E-03		2.8E+05	6.00E-03 D				3.30E-07		
Chlorophenol, 2-	5.00E-03 I				5.0E-01 R	2.50E-03		3.0E+04	1.1E-02 D				3.90E-04		
Dibenz(a,h)anthracene			7.30E+00 E		1.0E+00 3		7.30E+00	9.0E+07	2.7E+00 D	3.80E+06	2.02E-02	5.18E-06	6.03E-07	1.50E-12	9.02E+07
Dichlorobenzene, 1,2-	9.00E-02 I	4.00E-02 H			5.0E-01 R	4.50E-02		1.1E+04	6.1E-02 D				1.90E-03		
Dichlorobenzene, 1,3-	3.00E-02 E				5.0E-01 R	1.50E-02			8.7E-02 D				2.80E-03		
Dichlorobenzene, 1,4-	3.00E-02 E	2.29E-01 I	2.40E-02 H	2.20E-02 E	5.0E-01 R	1.50E-02	4.80E-02	1.1E+04	6.2E-02 D	6.17E+02	6.90E-02	7.90E-06	9.96E-02	9.32E-05	1.14E+04
Methylnaphthalene, 2-	2.00E-02 E				8.0E-01 A	1.60E-02			1.4E-01 D				2.60E-04		
Methylphenol, 4-	5.00E-03 H				6.5E-01 N	3.25E-03			1.0E-02 D				1.00E-06		
Naphthalene	2.00E-02 I	9.00E-04 I			8.0E-01 A	1.60E-02		5.5E+04	6.9E-02 D				4.80E-04		
Trichlorobenzene, 1,2,4-	1.00E-02 I	5.70E-02 H			5.0E-01 R	5.00E-03		3.8E+04	1.0E-01 D	1.78E+03	3.00E-02	8.23E-06	5.82E-02	8.38E-06	3.81E+04
Pesticide/PCBs Compounds															
Aroclor-1242			2.00E+00 I	2.00E+00 I	0.89 RfD/1.0 CSF N/3		2.00E+00		7.00E-01 D						
BHC, alpha-			6.30E+00 I	6.30E+00 I	5.0E-01 R		1.26E+01		1.80E-02 D				6.70E-06		
BHC, beta-			1.80E+00 I	1.80E+00 I	5.0E-01 R		3.60E+00		1.80E-02 D				7.00E-07		
BHC, delta-			1.80E+00 I	1.80E+00 I	5.0E-01 R		3.60E+00		1.80E-02 D				4.30E-07		
Dieldrin	5.00E-05 I		1.60E+01 I	1.60E+01 I	9.0E-01 A	2.50E-05	1.78E+01		1.60E-02 D				1.00E-05		
Heptachlor epoxide	1.30E-05 I		9.10E+00 I	9.10E+00 I	5.0E-01 R	6.50E-06	1.82E+01		1.1E-02 D,2				9.50E-06		
Total Inorganics															
Aluminum	1.00E+00 E	1.00E-03 E			5.00E-03 A	5.00E-03			1.00E-03 D,1						
Antimony	4.00E-04 I				1.00E-01 A	4.00E-05			1.00E-03 D,1						
Arsenic	3.00E-04 I		1.50E+00 I	1.51E+01 I	9.50E-01 N	2.85E-04	1.58E+00		1.00E-03 D,1						
Barium	7.00E-02 I	1.40E-04 HA			1.00E+00 N	7.00E-02			1.00E-03 D,1						

	RfDo (mg/kg-day)	RfDi (mg/kg-day)	CSFo (kg-day/mg)	CSFi (kg-day/mg)	Oral Absorption	RfDd (mg/kg-day)	CSFd (kg-day/mg)	Volatilization Factor (m^3/kg)	Permeability Coefficient (cm/hr)	Calculation of Soil-to-Air Volatilization Factor*					
										Koc	Di	Dw	H	DA	VF
Beryllium	2.00E-03 I	5.70E-06 I		8.40E+00 I	1.00E-02 A	2.00E-05			1.00E-03 D,1						
Cadmium (food -- *used for soil exposures*)	1.00E-03 I	5.70E-05 E		6.30E+00 I	2.50E-02 I	2.50E-05			1.0E-03 D						
Cadmium (water)	5.00E-04 I	5.70E-05 E		6.30E+00 I	5.00E-02 I	2.50E-05			1.0E-03 D						
Chromium	3.00E-03 I	3.00E-05 I		4.10E+01 H	1.00E-02 A	3.00E-05			2.0E-03 D						
Cobalt	2.00E-02 E	7.00E-06 E			3.00E-01 A	6.00E-03			4.00E-04 D,1						
Copper	4.00E-02 H				6.00E-01 A	2.40E-02			1.00E-03 D,1						
Iron	3.00E-01 E				1.0E+00 3	3.00E-01			1.00E-03 D,1						
Manganese (food -- *used for ingestion exposures*)	4.67E-02 I	1.43E-05 I			1.0E+00 3	4.67E-02			1.00E-03 D,1						
Manganese (nonfood -- *used for dermal and inhalation exposures*)	2.00E-02 I	1.43E-05 I			1.0E+00 3	2.00E-02			1.00E-03 D,1						
Mercury	1.00E-04 I	8.60E-05 I			1.0E+00 3	1.00E-04			1.0E-03 D						
Nickel	2.00E-02 I			8.40E-01 I	1.00E-01 N	2.00E-03			1.0E-04 D						
Vanadium	7.00E-03 H				2.00E-02 A	1.40E-04			1.00E-03 D,1						
Zinc	3.00E-01 I				2.50E-01 N	7.50E-02			6.00E-04 D						

Notes:

* Soil-to-Air Volatilization Factors shown only for those COPCs retained for quantitative risk assessment in soil; calculations based on *RAGS Part B*, USEPA Publ. 9285.7-01B, December 1991.

For Manganese (food) RfD_o shown here, a Modifying Factor of 3 was applied to the pulbished Manganese (food) RfD_o per IRIS, December 2001.

Mercury RfD_o based on methylmercury, RfD_i based on inorganic mercury.

Nickel CSF_i based on nickel refinery dust.

No dermal absorption adjustment to CSF_os was used for PAHs.

A = ATSDR Toxicity Profile.

D = *Dermal Exposure Assessment:Principles and Applications*, EPA/600/8-91-011B, January 1992.

E = NCEA as presented by USEPA Region III, Risk-Based Concentration Table, October 2001 Update.

I = IRIS, December 2001.

H = *HEAST, 1997 Update*, EPA/540/R-97/036, July 1997.

HA = HEAST Alternate, *HEAST, 1997 Update*, EPA/540/R-97/036, July 1997.

N = NCEA Guidance as provided by Region 3.

R = USEPA Region 4, November 1995.

1 = Based on water as surrogate.

2 = Based on heptachlor as surrogate.

3 = 1,1,2-Trichloro-1,2,2-trifluoroethane Permeability Coefficient based on Trichlorofluoromethane.

Table 7
Summary of Site Risks

Risks above the National Contingency Plan ("NCP") target risks are highlighted.

Receptor	Soil		Ground water		Total	
	HI	CR	HI	CR	HI	CR
Future Industrial worker	2*	1×10^{-4}**	**2648**	**2.3**	**2650**	**2.3**
Future Construction worker	2*	4×10^{-6}	**431**	**3**	**433**	**3**
Future Utility worker	0.1	3×10^{-7}	--	--	0.1	3×10^{-7}
Future Trespasser/visitor	1.4*	2×10^{-5}	--	--	1.4*	2×10^{-5}
Future Adult resident	**6**	**2×10^{-4}**	**4,616**	**4.4×10^{-1}**	**4,663**	**4.4×10^{-1}**
Future Child resident	**19**	**2×10^{-4}**	**4,713**	**7.4×10^{-1}**	**4,732**	**7.4×10^{-1}**

*HI does not truly exceed 1, because chemicals affect different target organs.

**Risk is at the upper end of the NCP risk range (1×10^{-6} to 1×10^{-4})

HI = Hazard Index

CR = Carcinogenic Risk

Table 8 - Risk Characterization Summary - Carcinogens

Scenario Timeframe:		Future						
Receptor Population:		Industrial Worker						
Receptor Age:		Adult						
Medium	**Exposure Medium**	**Exposure Point**	**Chemical of Concern**	**Carcinogenic Risk**				
				Ingestion	**Inhalation**	**Dermal**	**External (Radiation)**	**Exposure Routes Total**
Groundwater	Groundwater	Overburden GW	Acetone					
Groundwater	Groundwater	Overburden GW	benzene	2.69E-04	5.60E-04	3.00E-05		8.59E-04
Groundwater	Groundwater	Overburden GW	2-butanone					0.00E+00
Groundwater	Groundwater	Overburden GW	chlorobenzene					0.00E+00
Groundwater	Groundwater	Overburden GW	chloroform		2.30E-03	4.00E-06		2.30E-03
Groundwater	Groundwater	Overburden GW	1,1-dichloroethane					0.00E+00
Groundwater	Groundwater	Overburden GW	1,2-dichloroethane	1.14E-02	3.00E-02	5.00E-04		4.19E-02
Groundwater	Groundwater	Overburden GW	1,1-dichloroethene	1.80E-02	1.90E-02	2.60E-03		3.96E-02
Groundwater	Groundwater	Overburden GW	1,2-dichloroethene					0.00E+00
Groundwater	Groundwater	Overburden GW	ethylbenzene		2.10E-04			2.10E-04
Groundwater	Groundwater	Overburden GW	methylene chloride	1.94E-02	1.50E-02	7.00E-04		3.51E-02
Groundwater	Groundwater	Overburden GW	4-methyl-2-pentanone					0.00E+00
Groundwater	Groundwater	Overburden GW	1,1,2,2-tetrachloroethane	1.15E-03	2.20E-03	2.01E-04		3.55E-03
Groundwater	Groundwater	Overburden GW	tetrachloroethene	4.82E-03	2.80E-03	3.00E-03		1.06E-02
Groundwater	Groundwater	Overburden GW	toluene					0.00E+00
Groundwater	Groundwater	Overburden GW	1,1,1-trichloroethane					0.00E+00
Groundwater	Groundwater	Overburden GW	1,1,2-trichloroethane	3.59E-05	9.70E-05	4.00E-06		1.37E-04
Groundwater	Groundwater	Overburden GW	trichloroethene	1.10E-02	3.60E-02	2.20E-03		4.92E-02
Groundwater	Groundwater	Overburden GW	vinyl chloride	3.52E-02	3.20E-03	1.30E-03		3.97E-02
Groundwater	Groundwater	Overburden GW	4-chloroaniline					0.00E+00
Groundwater	Groundwater	Overburden GW	1,2-dichlorobenzene					0.00E+00
Groundwater	Groundwater	Overburden GW	1,4-dichlorobenzene	2.77E-04	7.60E-04	4.11E-04		1.45E-03
Groundwater	Groundwater	Overburden GW	4-methylphenol					0.00E+00
Groundwater	Groundwater	Overburden GW	1,2,4-trichlorobenzene					0.00E+00
Groundwater	Groundwater	Overburden GW	aluminum*					0.00E+00
Groundwater	Groundwater	Overburden GW	antimony*					0.00E+00
Groundwater	Groundwater	Overburden GW	cadmium*					0.00E+00
Groundwater	Groundwater	Overburden GW	chromium*					0.00E+00
Groundwater	Groundwater	Overburden GW	cobalt*					0.00E+00
Groundwater	Groundwater	Overburden GW	iron*					0.00E+00
Groundwater	Groundwater	Overburden GW	manganese*					0.00E+00
Groundwater	Groundwater	Overburden GW	nickel*					0.00E+00
Groundwater	Groundwater	Overburden GW	vanadium*					0.00E+00

Table 8 - Risk Characterization Summary - Carcinogens

Scenario Timeframe:		Future						
Receptor Population:		Industrial Worker						
Receptor Age:		Adult						
Medium	**Exposure Medium**	**Exposure Point**	**Chemical of Concern**	**Carcinogenic Risk**				
				Ingestion	**Inhalation**	**Dermal**	**External (Radiation)**	**Exposure Routes Total**
Groundwater	Groundwater	Overburden GW	zinc*					0.00E+00
Groundwater	Groundwater	Overburden GW	naphthalene*					0.00E+00
Groundwater	Groundwater	Overburden GW	arsenic*	5.30E-05		2.00E-07		5.32E-05
Groundwater	Groundwater	Overburden GW	copper*					0.00E+00
Groundwater	Groundwater	Overburden GW	chloroethane	4.26E-05		2.20E-06		4.48E-05
Groundwater	Groundwater	Overburden GW	bis(2-chloroethyl)ether	6.10E-04	1.70E-04	4.50E-05		8.25E-04
Groundwater	Groundwater	Overburden GW	delta-BHC	8.00E-06	4.00E-08	1.50E-05		2.30E-05
Groundwater	Groundwater	Overburden GW	dieldrin	4.16E-06	4.00E-07	7.00E-06		1.16E-05
				1.02E-01	1.12E-01	1.10E-02	**Total Risk =**	2.26E-01
Key								
***Chemical may ultimately be related to background.**								
Source: A Guide to Preparing Superfund Proposed Plans, Records of Decision, and Other Remedy Selection Decision Documents (U.S. EPA, 1999)								

Table 8 - Risk Characterization Summary - Carcinogens

Scenario Timeframe:		Future						
Receptor Population:		Construction Worker						
Receptor Age:		Adult						
Medium	**Exposure Medium**	**Exposure Point**	**Chemical of Concern**	**Carcinogenic Risk**				
				Ingestion	**Inhalation**	**Dermal**	**External (Radiation)**	**Exposure Routes Total**
Groundwater	Groundwater	Overburden GW	Acetone					
Groundwater	Groundwater	Overburden GW	benzene	5.40E-06	1.18E-05	2.40E-06		1.96E-05
Groundwater	Groundwater	Overburden GW	2-butanone					0.00E+00
Groundwater	Groundwater	Overburden GW	chlorobenzene					0.00E+00
Groundwater	Groundwater	Overburden GW	chloroform		5.64E-05			5.64E-05
Groundwater	Groundwater	Overburden GW	1,1-dichloroethane					0.00E+00
Groundwater	Groundwater	Overburden GW	1,2-dichloroethane	2.30E-04	9.51E-04	2.60E-05		1.21E-03
Groundwater	Groundwater	Overburden GW	1,1-dichloroethene	3.60E-04	4.37E-04	1.50E-04		9.47E-04
Groundwater	Groundwater	Overburden GW	1,2-dichloroethene					0.00E+00
Groundwater	Groundwater	Overburden GW	ethylbenzene					0.00E+00
Groundwater	Groundwater	Overburden GW	methylene chloride	3.90E-04	3.54E-04	4.70E-05		7.91E-04
Groundwater	Groundwater	Overburden GW	4-methyl-2-pentanone					0.00E+00
Groundwater	Groundwater	Overburden GW	1,1,2,2-tetrachloroethane	2.31E-05	9.61E-05	6.31E-06		1.26E-04
Groundwater	Groundwater	Overburden GW	tetrachloroethene	9.60E-05	1.56E-05	1.00E-04		2.12E-04
Groundwater	Groundwater	Overburden GW	toluene					0.00E+00
Groundwater	Groundwater	Overburden GW	1,1,1-trichloroethane					0.00E+00
Groundwater	Groundwater	Overburden GW	1,1,2-trichloroethane	7.20E-07	8.78E-06	1.70E-07		9.67E-06
Groundwater	Groundwater	Overburden GW	trichloroethene	2.20E-04	1.50E-05	1.00E-04		3.35E-04
Groundwater	Groundwater	Overburden GW	vinyl chloride	7.00E-04	1.22E-04	1.10E-04		9.32E-04
Groundwater	Groundwater	Overburden GW	4-chloroaniline					0.00E+00
Groundwater	Groundwater	Overburden GW	1,2-dichlorobenzene					0.00E+00
Groundwater	Groundwater	Overburden GW	1,4-dichlorobenzene	5.54E-06	1.20E-07	1.40E-05		1.97E-05
Groundwater	Groundwater	Overburden GW	4-methylphenol					0.00E+00
Groundwater	Groundwater	Overburden GW	1,2,4-trichlorobenzene					0.00E+00
Groundwater	Groundwater	Overburden GW	aluminum*					0.00E+00
Groundwater	Groundwater	Overburden GW	antimony*					0.00E+00
Groundwater	Groundwater	Overburden GW	cadmium*		5.00E-09			5.00E-09
Groundwater	Groundwater	Overburden GW	chromium*		7.00E-09			7.00E-09
Groundwater	Groundwater	Overburden GW	cobalt*					0.00E+00
Groundwater	Groundwater	Overburden GW	iron*					0.00E+00
Groundwater	Groundwater	Overburden GW	manganese*					0.00E+00
Groundwater	Groundwater	Overburden GW	nickel*		9.00E-11			9.00E-11
Groundwater	Groundwater	Overburden GW	vanadium*					0.00E+00

Table 8 - Risk Characterization Summary - Carcinogens

Scenario Timeframe:		Future						
Receptor Population:		Construction Worker						
Receptor Age:		Adult						
Medium	**Exposure Medium**	**Exposure Point**	**Chemical of Concern**	**Carcinogenic Risk**				
				Ingestion	**Inhalation**	**Dermal**	**External (Radiation)**	**Exposure Routes Total**
Groundwater	Groundwater	Overburden GW	zinc*					0.00E+00
Groundwater	Groundwater	Overburden GW	naphthalene*					0.00E+00
Groundwater	Groundwater	Overburden GW	arsenic*	3.11E-06	6.40E-10	2.12E-07		3.32E-06
Groundwater	Groundwater	Overburden GW	copper*					0.00E+00
Groundwater	Groundwater	Overburden GW	chloroethane	8.50E-07		1.80E-07		1.03E-06
Groundwater	Groundwater	Overburden GW	bis(2-chloroethyl)ether	0.00E+00	0.00E+00	0.00E+00		0.00E+00
Groundwater	Groundwater	Overburden GW	delta-BHC	1.60E-07	0.00E+00	2.50E-07		4.10E-07
Groundwater	Groundwater	Overburden GW	dieldrin	8.40E-08	0.00E+00	1.20E-07		2.04E-07
				2.04E-03	2.07E-03	5.57E-04	**Total Risk =**	4.66E-03
Key								
***Chemical may ultimately be related to background.**								
Source: A Guide to Preparing Superfund Proposed Plans, Records of Decision, and Other Remedy Selection Decision Documents (U.S. EPA, 1999)								

Table 8 - Risk Characterization Summary - Carcinogens

Scenario Timeframe:		Future						
Receptor Population:		On-Site Resident						
Receptor Age:		Adult						
Medium	**Exposure Medium**	**Exposure Point**	**Chemical of Concern**	**Carcinogenic Risk**				
				Ingestion	**Inhalation**	**Dermal**	**External (Radiation)**	**Exposure Routes Total**
Groundwater	Groundwater	Overburden GW	Acetone					
Groundwater	Groundwater	Overburden GW	benzene	7.23E-04	7.50E-04	4.50E-05		1.52E-03
Groundwater	Groundwater	Overburden GW	2-butanone					0.00E+00
Groundwater	Groundwater	Overburden GW	chlorobenzene					0.00E+00
Groundwater	Groundwater	Overburden GW	chloroform		2.50E-03			2.50E-03
Groundwater	Groundwater	Overburden GW	1,1-dichloroethane					0.00E+00
Groundwater	Groundwater	Overburden GW	1,2-dichloroethane	3.08E-02	4.70E-02	7.16E-04		7.85E-02
Groundwater	Groundwater	Overburden GW	1,1-dichloroethene	4.85E-02	2.60E-02	3.07E-03		7.76E-02
Groundwater	Groundwater	Overburden GW	1,2-dichloroethene					0.00E+00
Groundwater	Groundwater	Overburden GW	ethylbenzene		2.80E-04			2.80E-04
Groundwater	Groundwater	Overburden GW	methylene chloride	5.21E-02	2.00E-02	1.00E-03		7.31E-02
Groundwater	Groundwater	Overburden GW	4-methyl-2-pentanone					0.00E+00
Groundwater	Groundwater	Overburden GW	1,1,2,2-tetrachloroethane	3.10E-03	2.52E-03	3.00E-04		5.92E-03
Groundwater	Groundwater	Overburden GW	tetrachloroethene	1.29E-02	3.81E-03	4.00E-03		2.07E-02
Groundwater	Groundwater	Overburden GW	toluene					0.00E+00
Groundwater	Groundwater	Overburden GW	1,1,1-trichloroethane					0.00E+00
Groundwater	Groundwater	Overburden GW	1,1,2-trichloroethane	9.60E-05	1.00E-04	6.00E-06		2.02E-04
Groundwater	Groundwater	Overburden GW	trichloroethene	3.00E-02	6.00E-04	3.00E-03		3.36E-02
Groundwater	Groundwater	Overburden GW	vinyl chloride	9.00E-02	4.00E-03	2.00E-03		9.60E-02
Groundwater	Groundwater	Overburden GW	4-chloroaniline					0.00E+00
Groundwater	Groundwater	Overburden GW	1,2-dichlorobenzene					0.00E+00
Groundwater	Groundwater	Overburden GW	1,4-dichlorobenzene	7.44E-04	1.01E-03	5.50E-04		2.30E-03
Groundwater	Groundwater	Overburden GW	4-methylphenol					0.00E+00
Groundwater	Groundwater	Overburden GW	1,2,4-trichlorobenzene					0.00E+00
Groundwater	Groundwater	Overburden GW	aluminum*					0.00E+00
Groundwater	Groundwater	Overburden GW	antimony*					0.00E+00
Groundwater	Groundwater	Overburden GW	cadmium*					0.00E+00
Groundwater	Groundwater	Overburden GW	chromium*					0.00E+00
Groundwater	Groundwater	Overburden GW	cobalt*					0.00E+00
Groundwater	Groundwater	Overburden GW	iron*					0.00E+00
Groundwater	Groundwater	Overburden GW	manganese*					0.00E+00
Groundwater	Groundwater	Overburden GW	nickel*					0.00E+00
Groundwater	Groundwater	Overburden GW	vanadium*					0.00E+00

Table 8 - Risk Characterization Summary - Carcinogens

Scenario Timeframe: Future
Receptor Population: On-Site Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Concern	Carcinogenic Risk				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total
Groundwater	Groundwater	Overburden GW	zinc*					0.00E+00
Groundwater	Groundwater	Overburden GW	naphthalene*					0.00E+00
Groundwater	Groundwater	Overburden GW	arsenic*	1.00E-04		3.00E-07		1.00E-04
Groundwater	Groundwater	Overburden GW	copper*					0.00E+00
Groundwater	Groundwater	Overburden GW	chloroethane	1.14E-04		3.00E-06		1.17E-04
Groundwater	Groundwater	Overburden GW	bis(2-chloroethyl)ether	1.60E-03	2.00E-04	6.00E-05		1.86E-03
Groundwater	Groundwater	Overburden GW	delta-BHC	2.00E-05	5.00E-08	2.00E-05		4.01E-05
Groundwater	Groundwater	Overburden GW	dieldrin	1.12E-05	5.00E-07	9.00E-06		2.07E-05
				2.71E-01	1.09E-01	1.48E-02	**Total Risk =**	3.94E-01

Key

***Chemical may ultimately be related to background.**

Source: A Guide to Preparing Superfund Proposed Plans, Records of Decision, and Other Remedy Selection Decision Documents (U.S. EPA, 1999)

Table 8 - Risk Characterization Summary - Carcinogens

Scenario Timeframe:		Future						
Receptor Population:		On-Site Resident						
Receptor Age:		Child						
Medium	**Exposure Medium**	**Exposure Point**	**Chemical of Concern**	**Carcinogenic Risk**				
				Ingestion	**Inhalation**	**Dermal**	**External (Radiation)**	**Exposure Routes Total**
Groundwater	Groundwater	Overburden GW	Acetone					
Groundwater	Groundwater	Overburden GW	benzene	4.20E-04		5.00E-05	-	4.70E-04
Groundwater	Groundwater	Overburden GW	2-butanone					0.00E+00
Groundwater	Groundwater	Overburden GW	chlorobenzene					0.00E+00
Groundwater	Groundwater	Overburden GW	chloroform					0.00E+00
Groundwater	Groundwater	Overburden GW	1,1-dichloroethane					0.00E+00
Groundwater	Groundwater	Overburden GW	1,2-dichloroethane	1.80E-02		6.50E-04		1.87E-02
Groundwater	Groundwater	Overburden GW	1,1-dichloroethene	2.80E-02		3.80E-03		3.18E-02
Groundwater	Groundwater	Overburden GW	1,2-dichloroethene					0.00E+00
Groundwater	Groundwater	Overburden GW	ethylbenzene					0.00E+00
Groundwater	Groundwater	Overburden GW	methylene chloride	3.00E-02		1.00E-03		3.10E-02
Groundwater	Groundwater	Overburden GW	4-methyl-2-pentanone					0.00E+00
Groundwater	Groundwater	Overburden GW	1,1,2,2-tetrachloroethane	1.80E-03	1.48E-05	2.21E-04		2.04E-03
Groundwater	Groundwater	Overburden GW	tetrachloroethene	7.50E-03	7.40E-06	4.00E-03		1.15E-02
Groundwater	Groundwater	Overburden GW	toluene					0.00E+00
Groundwater	Groundwater	Overburden GW	1,1,1-trichloroethane					0.00E+00
Groundwater	Groundwater	Overburden GW	1,1,2-trichloroethane					0.00E+00
Groundwater	Groundwater	Overburden GW	trichloroethene	2.30E-06	1.71E-02	3.20E-03		2.03E-02
Groundwater	Groundwater	Overburden GW	vinyl chloride	4.90E-01	6.00E-06	2.70E-02		5.17E-01
Groundwater	Groundwater	Overburden GW	4-chloroaniline					0.00E+00
Groundwater	Groundwater	Overburden GW	1,2-dichlorobenzene					0.00E+00
Groundwater	Groundwater	Overburden GW	1,4-dichlorobenzene	9.31E-04	5.57E-06	5.50E-04		1.49E-03
Groundwater	Groundwater	Overburden GW	4-methylphenol					0.00E+00
Groundwater	Groundwater	Overburden GW	1,2,4-trichlorobenzene					0.00E+00
Groundwater	Groundwater	Overburden GW	aluminum*					0.00E+00
Groundwater	Groundwater	Overburden GW	antimony*					0.00E+00
Groundwater	Groundwater	Overburden GW	cadmium*					0.00E+00
Groundwater	Groundwater	Overburden GW	chromium*					0.00E+00
Groundwater	Groundwater	Overburden GW	cobalt*					0.00E+00
Groundwater	Groundwater	Overburden GW	iron*					0.00E+00
Groundwater	Groundwater	Overburden GW	manganese*					0.00E+00
Groundwater	Groundwater	Overburden GW	nickel*		4.20E-09			4.20E-09
Groundwater	Groundwater	Overburden GW	vanadium*					0.00E+00

Table 8 - Risk Characterization Summary - Carcinogens

Scenario Timeframe:		Future						
Receptor Population:		On-Site Resident						
Receptor Age:		Child						
Medium	**Exposure Medium**	**Exposure Point**	**Chemical of Concern**	**Carcinogenic Risk**				
				Ingestion	**Inhalation**	**Dermal**	**External (Radiation)**	**Exposure Routes Total**
Groundwater	Groundwater	Overburden GW	zinc*					0.00E+00
Groundwater	Groundwater	Overburden GW	naphthalene*					0.00E+00
Groundwater	Groundwater	Overburden GW	arsenic*	1.50E-04	3.01E-08	1.92E-05		1.69E-04
Groundwater	Groundwater	Overburden GW	copper*					0.00E+00
Groundwater	Groundwater	Overburden GW	chloroethane					0.00E+00
Groundwater	Groundwater	Overburden GW	bis(2-chloroethyl)ether	9.60E-04		3.70E-05		9.97E-04
Groundwater	Groundwater	Overburden GW	delta-BHC	1.20E-05		1.20E-05		2.40E-05
Groundwater	Groundwater	Overburden GW	dieldrin	6.60E-06		6.60E-06		1.32E-05
				5.78E-01	1.71E-02	4.05E-02	**Total Risk =**	6.35E-01
Key								
***Chemical may ultimately be related to background.**								
Source: A Guide to Preparing Superfund Proposed Plans, Records of Decision, and Other Remedy Selection Decision Documents (U.S. EPA, 1999)								

Table 8 - Risk Characterization Summary - Non-Carcinogens

Scenario Timeframe:		Future						
Receptor Population:		Industrial Worker						
Receptor Age:		Adult						
Medium	Exposure Medium	Exposure Point	Chemical of Concern	Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total
Groundwater	Groundwater	Overburden GW	Acetone			0.16		
Groundwater	Groundwater	Overburden GW	benzene	1.20E+01		7.00E-01	-	1.27E+01
Groundwater	Groundwater	Overburden GW	2-butanone	3.00E-01		3.50E-03		3.04E-01
Groundwater	Groundwater	Overburden GW	chlorobenzene	1.00E+01		4.60E+00		1.46E+01
Groundwater	Groundwater	Overburden GW	chloroform	2.30E+00		2.00E-01		2.50E+00
Groundwater	Groundwater	Overburden GW	1,1-dichloroethane	3.70E+00		3.00E-01		4.00E+00
Groundwater	Groundwater	Overburden GW	1,2-dichloroethane	1.20E+01		5.00E-01		1.25E+01
Groundwater	Groundwater	Overburden GW	1,1-dichloroethene	9.30E+00		1.30E+00		1.06E+01
Groundwater	Groundwater	Overburden GW	1,2-dichloroethene	5.70E+01		4.10E+00		6.11E+01
Groundwater	Groundwater	Overburden GW	ethylbenzene	4.20E-01		2.70E-01		6.90E-01
Groundwater	Groundwater	Overburden GW	methylene chloride	1.20E+02		4.60E+00		1.25E+02
Groundwater	Groundwater	Overburden GW	4-methyl-2-pentanone	2.20E+00		1.00E-01		2.30E+00
Groundwater	Groundwater	Overburden GW	1,1,2,2-tetrachloroethane	2.70E-01	2.80E-08	5.01E-02		3.20E-01
Groundwater	Groundwater	Overburden GW	tetrachloroethene	2.60E+01	5.62E+00	1.70E+01		4.86E+01
Groundwater	Groundwater	Overburden GW	toluene	1.80E+00	1.20E+01	5.50E-01		1.44E+01
Groundwater	Groundwater	Overburden GW	1,1,1-trichloroethane	2.90E+00	4.3	0.6		7.80E+00
Groundwater	Groundwater	Overburden GW	1,1,2-trichloroethane	4.00E-01		5.00E-02		4.50E-01
Groundwater	Groundwater	Overburden GW	trichloroethene	2.60E+02	2.60E+01	5.20E+01		3.38E+02
Groundwater	Groundwater	Overburden GW	vinyl chloride	4.60E+01	2.10E+01	1.60E+00		6.86E+01
Groundwater	Groundwater	Overburden GW	4-chloroaniline			4.70E+00		4.70E+00
Groundwater	Groundwater	Overburden GW	1,2-dichlorobenzene	2.70E+00	1.80E+01	4.00E+00		2.47E+01
Groundwater	Groundwater	Overburden GW	1,4-dichlorobenzene	9.00E-04	4.03E-01	1.60E+00		2.01E+00
Groundwater	Groundwater	Overburden GW	4-methylphenol	1.70E+00		4.00E-01		2.10E+00
Groundwater	Groundwater	Overburden GW	1,2,4-trichlorobenzene	9.38E-02	5.40E-02	3.47E-01		4.95E-01
Groundwater	Groundwater	Overburden GW	aluminum*	1.71E+00	1.80E-03	1.65E+00		3.36E+00
Groundwater	Groundwater	Overburden GW	antimony*	3.51E+00		1.70E-01		3.68E+00
Groundwater	Groundwater	Overburden GW	cadmium*	1.34E+00	2.00E-04	5.10E-01		1.85E+00
Groundwater	Groundwater	Overburden GW	chromium*	1.90E-01	8.00E-04	1.70E+00		1.89E+00
Groundwater	Groundwater	Overburden GW	cobalt*	3.00E-01		7.60E-04		3.01E-01
Groundwater	Groundwater	Overburden GW	iron*	1.60E+01		7.40E-02		1.61E+01
Groundwater	Groundwater	Overburden GW	manganese*	3.71E+00	3.00E-03	1.20E-02		3.72E+00
Groundwater	Groundwater	Overburden GW	nickel*	3.02E-01		8.30E-03		3.11E-01
Groundwater	Groundwater	Overburden GW	vanadium*	6.00E-01		1.00E-01		7.00E-01

Table 8 - Risk Characterization Summary - Non-Carcinogens								
Scenario Timeframe:		Future						
Receptor Population:		Industrial Worker						
Receptor Age:		Adult						
Medium	**Exposure Medium**	**Exposure Point**	**Chemical of Concern**	**Hazard Quotient**				
				Ingestion	**Inhalation**	**Dermal**	**External (Radiation)**	**Exposure Routes Total**
Groundwater	Groundwater	Overburden GW	zinc*	8.00E-02		7.00E-04		8.07E-02
Groundwater	Groundwater	Overburden GW	naphthalene*	1.40E-02	7.00E-02	1.00E-02		9.40E-02
Groundwater	Groundwater	Overburden GW	arsenic*	6.52E-02	0.00E+00	1.00E-03		6.62E-02
Groundwater	Groundwater	Overburden GW	copper*			2.00E-03		2.00E-03
Groundwater	Groundwater	Overburden GW	chloroethane			5.00E-03		5.00E-03
Groundwater	Groundwater	Overburden GW	bis(2-chloroethyl)ether					0.00E+00
Groundwater	Groundwater	Overburden GW	delta-BHC	0.00E+00				0.00E+00
Groundwater	Groundwater	Overburden GW	dieldrin	1.50E-02		2.50E-02		4.00E-02
				5.99E+02	8.75E+01	1.04E+02	**Total Risk =**	7.90E+02
Key								
***Chemical may ultimately be related to background.**								
Source: A Guide to Preparing Superfund Proposed Plans, Records of Decision, and Other Remedy Selection Decision Documents (U.S. EPA, 1999)								

Table 8 - Risk Characterization Summary - Non-Carcinogens

Scenario Timeframe:		Future						
Receptor Population:		Construction Worker						
Receptor Age:		Adult						
Medium	**Exposure Medium**	**Exposure Point**	**Chemical of Concern**	**Hazard Quotient**				
				Ingestion	**Inhalation**	**Dermal**	**External (Radiation)**	**Exposure Routes Total**
Groundwater	Groundwater	Overburden GW	Acetone	5.9		0.09		
Groundwater	Groundwater	Overburden GW	benzene	2.30E+00	1.18E-05	1.30E+00	-	3.60E+00
Groundwater	Groundwater	Overburden GW	2-butanone	1.50E-01				1.50E-01
Groundwater	Groundwater	Overburden GW	chlorobenzene	5.10E+00		5.60E+00		1.07E+01
Groundwater	Groundwater	Overburden GW	chloroform	1.20E+00	5.64E-05	2.00E-01		1.40E+00
Groundwater	Groundwater	Overburden GW	1,1-dichloroethane	1.90E+00		4.00E-01		2.30E+00
Groundwater	Groundwater	Overburden GW	1,2-dichloroethane	5.90E+00	9.51E-04	6.80E-01		6.58E+00
Groundwater	Groundwater	Overburden GW	1,1-dichloroethene	4.70E+00	4.37E-04	2.00E+00		6.70E+00
Groundwater	Groundwater	Overburden GW	1,2-dichloroethene	2.80E+01		6.10E+00		3.41E+01
Groundwater	Groundwater	Overburden GW	ethylbenzene	2.10E-01		3.00E-01		5.10E-01
Groundwater	Groundwater	Overburden GW	methylene chloride	6.00E+01	3.54E-04	7.30E+00		6.73E+01
Groundwater	Groundwater	Overburden GW	4-methyl-2-pentanone	1.10E+00		1.00E-01		1.20E+00
Groundwater	Groundwater	Overburden GW	1,1,2,2-tetrachloroethane	1.31E-01	9.58E-05	3.71E-02		1.68E-01
Groundwater	Groundwater	Overburden GW	tetrachloroethene	1.30E+01	8.02E-03	1.40E+01		2.70E+01
Groundwater	Groundwater	Overburden GW	toluene	8.80E-01		8.00E-01		1.68E+00
Groundwater	Groundwater	Overburden GW	1,1,1-trichloroethane	1.50E+00		0.7		2.20E+00
Groundwater	Groundwater	Overburden GW	1,1,2-trichloroethane	2.00E-01	8.78E-06	5.00E-02		2.50E-01
Groundwater	Groundwater	Overburden GW	trichloroethene	1.30E+02	2.00E-02	5.00E+00		1.35E+02
Groundwater	Groundwater	Overburden GW	vinyl chloride	2.30E+01	2.12E-03	3.50E+00		2.65E+01
Groundwater	Groundwater	Overburden GW	4-chloroaniline	1.20E+01		3.30E+00		1.53E+01
Groundwater	Groundwater	Overburden GW	1,2-dichlorobenzene	1.40E+00		3.50E+00		4.90E+00
Groundwater	Groundwater	Overburden GW	1,4-dichlorobenzene	5.43E-01	2.00E-03	1.40E+00		1.95E+00
Groundwater	Groundwater	Overburden GW	4-methylphenol	8.50E-01		3.00E-01		1.15E+00
Groundwater	Groundwater	Overburden GW	1,2,4-trichlorobenzene	7.80E-02	7.00E-03	2.23E-01		3.08E-01
Groundwater	Groundwater	Overburden GW	aluminum*	8.98E-01	9.00E-04	3.68E+00		4.58E+00
Groundwater	Groundwater	Overburden GW	antimony*	1.77E+00		3.70E-01		2.14E+00
Groundwater	Groundwater	Overburden GW	cadmium*	4.90E-01	1.00E-04	3.40E-01		8.30E-01
Groundwater	Groundwater	Overburden GW	chromium*	7.30E-01	4.00E-04	2.90E+00		3.63E+00
Groundwater	Groundwater	Overburden GW	cobalt*	8.00E-02		2.00E-03		8.20E-02
Groundwater	Groundwater	Overburden GW	iron*	8.22E+00		4.70E-02		8.27E+00
Groundwater	Groundwater	Overburden GW	manganese*	1.93E+00		1.00E-03		1.93E+00
Groundwater	Groundwater	Overburden GW	nickel*	1.70E-01		6.70E-03		1.77E-01
Groundwater	Groundwater	Overburden GW	vanadium*	3.00E-02		3.00E-01		3.30E-01

Table 8 - Risk Characterization Summary - Non-Carcinogens

Scenario Timeframe:		Future						
Receptor Population:		Construction Worker						
Receptor Age:		Adult						
Medium	**Exposure Medium**	**Exposure Point**	**Chemical of Concern**	**Hazard Quotient**				
				Ingestion	**Inhalation**	**Dermal**	**External (Radiation)**	**Exposure Routes Total**
Groundwater	Groundwater	Overburden GW	zinc*	4.00E-02		2.00E-03		4.20E-02
Groundwater	Groundwater	Overburden GW	naphthalene*					0.00E+00
Groundwater	Groundwater	Overburden GW	arsenic*	4.83E-01		3.70E-02		5.20E-01
Groundwater	Groundwater	Overburden GW	copper*	1.60E-01				1.60E-01
Groundwater	Groundwater	Overburden GW	chloroethane	5.00E-02		1.00E-02		6.00E-02
Groundwater	Groundwater	Overburden GW	bis(2-chloroethyl)ether					0.00E+00
Groundwater	Groundwater	Overburden GW	delta-BHC					0.00E+00
Groundwater	Groundwater	Overburden GW	dieldrin	7.00E-03		1.00E-02		1.70E-02
				3.15E+02	4.25E-02	6.46E+01	**Total Risk =**	3.74E+02
Key								
***Chemical may ultimately be related to background.**								
Source: A Guide to Preparing Superfund Proposed Plans, Records of Decision, and Other Remedy Selection Decision Documents (U.S. EPA, 1999)								

Table 8 - Risk Characterization Summary - Non-Carcinogens

Scenario Timeframe:		Future						
Receptor Population:		On-Site Resident						
Receptor Age:		Adult						
Medium	Exposure Medium	Exposure Point	Chemical of Concern	Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total
Groundwater	Groundwater	Overburden GW	Acetone	33		0.2		
Groundwater	Groundwater	Overburden GW	benzene	1.30E+01	4.40E+01	1.00E+00	-	5.80E+01
Groundwater	Groundwater	Overburden GW	2-butanone	8.70E-01	8.00E-01	5.00E-03		1.68E+00
Groundwater	Groundwater	Overburden GW	chlorobenzene	2.90E+01	5.70E+01	6.40E+00		9.24E+01
Groundwater	Groundwater	Overburden GW	chloroform	6.60E+00	1.30E+03	3.00E-01		1.31E+03
Groundwater	Groundwater	Overburden GW	1,1-dichloroethane	1.00E+01	1.30E+01	4.00E-01		2.34E+01
Groundwater	Groundwater	Overburden GW	1,2-dichloroethane	3.30E+01	1.10E+03	7.00E-01		1.13E+03
Groundwater	Groundwater	Overburden GW	1,1-dichloroethene	2.60E+01		1.90E+00		2.79E+01
Groundwater	Groundwater	Overburden GW	1,2-dichloroethene	1.60E+02		5.70E+00		1.66E+02
Groundwater	Groundwater	Overburden GW	ethylbenzene	1.20E+00	7.00E-01	4.00E-01		2.30E+00
Groundwater	Groundwater	Overburden GW	methylene chloride	3.40E+02	4.30E+01	6.40E+00		3.89E+02
Groundwater	Groundwater	Overburden GW	4-methyl-2-pentanone	6.20E+00	2.00E+01	2.00E-01		2.64E+01
Groundwater	Groundwater	Overburden GW	1,1,2,2-tetrachloroethane	7.50E-01	1.40E-10	7.04E-02		8.21E-01
Groundwater	Groundwater	Overburden GW	tetrachloroethene	3.56E-03	8.02E+00	2.30E+01		3.10E+01
Groundwater	Groundwater	Overburden GW	toluene	4.90E+00	1.60E+01	8.00E-01		2.17E+01
Groundwater	Groundwater	Overburden GW	1,1,1-trichloroethane	8.10E+00	6.00E+00	0.9		1.50E+01
Groundwater	Groundwater	Overburden GW	1,1,2-trichloroethane	1.20E+00		7.00E-02		1.27E+00
Groundwater	Groundwater	Overburden GW	trichloroethene	1.30E+02	3.61E+01	7.30E+01		2.39E+02
Groundwater	Groundwater	Overburden GW	vinyl chloride	1.30E+02	3.45E+01	2.30E+00		1.67E+02
Groundwater	Groundwater	Overburden GW	4-chloroaniline	6.80E+01		6.60E+00		7.46E+01
Groundwater	Groundwater	Overburden GW	1,2-dichlorobenzene	7.60E+00	2.50E+01	5.60E+00		3.82E+01
Groundwater	Groundwater	Overburden GW	1,4-dichlorobenzene	3.00E+00	9.60E+00	0.00E+00		1.26E+01
Groundwater	Groundwater	Overburden GW	4-methylphenol	4.80E+00		5.00E-01		5.30E+00
Groundwater	Groundwater	Overburden GW	1,2,4-trichlorobenzene	2.22E-01	7.00E-02	4.92E-01		7.84E-01
Groundwater	Groundwater	Overburden GW	aluminum*	5.16E+00	2.00E-03	1.80E+00		6.97E+00
Groundwater	Groundwater	Overburden GW	antimony*	9.74E+00		2.96E-01		1.00E+01
Groundwater	Groundwater	Overburden GW	cadmium*	1.81E+00	3.00E-04	1.38E+00		3.19E+00
Groundwater	Groundwater	Overburden GW	chromium*	3.67E+00	1.00E-03	3.55E+00		7.23E+00
Groundwater	Groundwater	Overburden GW	cobalt*	4.00E-01		1.00E-03		4.01E-01
Groundwater	Groundwater	Overburden GW	iron*	4.51E+01		1.20E-01		4.53E+01
Groundwater	Groundwater	Overburden GW	manganese*	1.00E+01	4.00E-03	2.57E-02		1.00E+01
Groundwater	Groundwater	Overburden GW	nickel*	9.07E-01	0.00E+00	2.25E-02		9.29E-01
Groundwater	Groundwater	Overburden GW	vanadium*	1.70E+00		1.60E-01		1.86E+00

Table 8 - Risk Characterization Summary - Non-Carcinogens

Scenario Timeframe:		Future						
Receptor Population:		On-Site Resident						
Receptor Age:		Adult						
Medium	**Exposure Medium**	**Exposure Point**	**Chemical of Concern**	**Hazard Quotient**				
				Ingestion	**Inhalation**	**Dermal**	**External (Radiation)**	**Exposure Routes Total**
Groundwater	Groundwater	Overburden GW	zinc*	2.00E-01		1.00E-03		2.01E-01
Groundwater	Groundwater	Overburden GW	naphthalene*	4.00E-02	1.00E+00	2.00E-02		1.06E+00
Groundwater	Groundwater	Overburden GW	arsenic*	1.08E+00	0.00E+00	1.87E-01		1.27E+00
Groundwater	Groundwater	Overburden GW	copper*	9.00E-01		3.00E-03		9.03E-01
Groundwater	Groundwater	Overburden GW	chloroethane	2.90E-01	8.50E-02	7.00E-03		3.82E-01
Groundwater	Groundwater	Overburden GW	bis(2-chloroethyl)ether					0.00E+00
Groundwater	Groundwater	Overburden GW	delta-BHC	0.00E+00		0.00E+00		0.00E+00
Groundwater	Groundwater	Overburden GW	dieldrin	4.00E-02		3.00E-02		7.00E-02
				1.10E+03	2.71E+03	1.45E+02	**Total Risk =**	3.92E+03
Key								
***Chemical may ultimately be related to background.**								
Source: A Guide to Preparing Superfund Proposed Plans, Records of Decision, and Other Remedy Selection Decision Documents (U.S. EPA, 1999)								

Table 8 - Risk Characterization Summary - Non-Carcinogens

Scenario Timeframe:		Future						
Receptor Population:		On-Site Resident						
Receptor Age:		Child						
Medium	**Exposure Medium**	**Exposure Point**	**Chemical of Concern**	**Hazard Quotient**				
				Ingestion	**Inhalation**	**Dermal**	**External (Radiation)**	**Exposure Routes Total**
Groundwater	Groundwater	Overburden GW	Acetone	77		0.5		
Groundwater	Groundwater	Overburden GW	benzene	3.00E+01		4.60E+00	-	3.46E+01
Groundwater	Groundwater	Overburden GW	2-butanone	2.00E+00		1.30E-02		2.01E+00
Groundwater	Groundwater	Overburden GW	chlorobenzene	6.70E+01		2.80E+01		9.50E+01
Groundwater	Groundwater	Overburden GW	chloroform	1.50E+01		1.10E+00		1.61E+01
Groundwater	Groundwater	Overburden GW	1,1-dichloroethane	2.40E+01		1.80E+00		2.58E+01
Groundwater	Groundwater	Overburden GW	1,2-dichloroethane	7.70E+01		2.80E+00		7.98E+01
Groundwater	Groundwater	Overburden GW	1,1-dichloroethene	6.10E+01		8.70E+00		6.97E+01
Groundwater	Groundwater	Overburden GW	1,2-dichloroethene	3.70E+02		2.60E+01		3.96E+02
Groundwater	Groundwater	Overburden GW	ethylbenzene	2.70E+00		1.70E+00		4.40E+00
Groundwater	Groundwater	Overburden GW	methylene chloride	7.90E+02		2.90E+01		8.19E+02
Groundwater	Groundwater	Overburden GW	4-methyl-2-pentanone	1.40E+01		5.00E-01		1.45E+01
Groundwater	Groundwater	Overburden GW	1,1,2,2-tetrachloroethane	1.80E+00		2.21E-01		2.02E+00
Groundwater	Groundwater	Overburden GW	tetrachloroethene	1.70E+02	6.00E-02	9.40E+01		2.64E+02
Groundwater	Groundwater	Overburden GW	toluene	1.20E+01		3.60E+00		1.56E+01
Groundwater	Groundwater	Overburden GW	1,1,1-trichloroethane	19		3.7		2.27E+01
Groundwater	Groundwater	Overburden GW	1,1,2-trichloroethane	2.90E+00		2.60E-01		3.16E+00
Groundwater	Groundwater	Overburden GW	trichloroethene	1.70E+03	1.60E-01	3.10E+02		2.01E+03
Groundwater	Groundwater	Overburden GW	vinyl chloride	3.00E+02	1.00E-02	1.20E+01		3.12E+02
Groundwater	Groundwater	Overburden GW	4-chloroaniline	1.60E+02		1.70E+01		1.77E+02
Groundwater	Groundwater	Overburden GW	1,2-dichlorobenzene	1.80E+01		2.20E+01		4.00E+01
Groundwater	Groundwater	Overburden GW	1,4-dichlorobenzene	1.88E-02	1.11E-02	8.83E+00		8.86E+00
Groundwater	Groundwater	Overburden GW	4-methylphenol	1.10E+01		1.20E+00		1.22E+01
Groundwater	Groundwater	Overburden GW	1,2,4-trichlorobenzene	6.00E-01		1.64E+00		2.24E+00
Groundwater	Groundwater	Overburden GW	aluminum*	1.12E+01	6.90E-03	8.00E+00		1.92E+01
Groundwater	Groundwater	Overburden GW	antimony*	2.34E+01		8.43E-01		2.42E+01
Groundwater	Groundwater	Overburden GW	cadmium*	5.03E+00	8.00E-04	3.64E+00		8.67E+00
Groundwater	Groundwater	Overburden GW	chromium*	9.00E+00	3.00E-03	9.87E+00		1.89E+01
Groundwater	Groundwater	Overburden GW	cobalt*	1.00E+00		3.00E-03		1.00E+00
Groundwater	Groundwater	Overburden GW	iron*	1.01E+02		3.50E-01		1.02E+02
Groundwater	Groundwater	Overburden GW	manganese*	2.40E+01	1.00E-02	7.30E-02		2.41E+01
Groundwater	Groundwater	Overburden GW	nickel*	2.16E+00		5.87E-02		2.22E+00
Groundwater	Groundwater	Overburden GW	vanadium*	4.00E+00		5.00E-01		4.50E+00

Table 8 - Risk Characterization Summary - Non-Carcinogens

Scenario Timeframe:		Future						
Receptor Population:		On-Site Resident						
Receptor Age:		Child						
Medium	**Exposure Medium**	**Exposure Point**	**Chemical of Concern**	**Hazard Quotient**				
				Ingestion	**Inhalation**	**Dermal**	**External (Radiation)**	**Exposure Routes Total**
Groundwater	Groundwater	Overburden GW	zinc*	5.00E-01		2.90E-03		5.03E-01
Groundwater	Groundwater	Overburden GW	naphthalene*	9.00E-02		6.90E-02		1.59E-01
Groundwater	Groundwater	Overburden GW	arsenic*	3.90E+00		4.88E-01		4.39E+00
Groundwater	Groundwater	Overburden GW	copper*	2.00E+00		8.00E-03		2.01E+00
Groundwater	Groundwater	Overburden GW	chloroethane	6.70E-01		3.60E-02		7.06E-01
Groundwater	Groundwater	Overburden GW	bis(2-chloroethyl)ether					0.00E+00
Groundwater	Groundwater	Overburden GW	delta-BHC	0.00E+00		0.00E+00		0.00E+00
Groundwater	Groundwater	Overburden GW	dieldrin	9.00E-02		9.00E-02		1.80E-01
				4.11E+03	2.62E-01	6.03E+02	**Total Risk =**	4.64E+03
Key								
***Chemical may ultimately be related to background.**								
Source: A Guide to Preparing Superfund Proposed Plans, Records of Decision, and Other Remedy Selection Decision Documents (U.S. EPA, 1999)								

Table 9
Applicable and Relevant and Appropriate Requirements (ARARs)
Contaminated Shallow Soils, Operable Unit 1 Record of Decision
Spectron Superfund Site

	ARAR or TBC	Legal Citation	Classification	Summary of Requirement	Further Details Regarding ARARs in the Context of the Selected Remedy
	Clean Water Act: Federal Ambient Water Quality Criteria for the Protection of Aquatic Life	33 U.S.C. § 1314	Relevant and Appropriate	These are non-enforceable guidelines established pursuant to Section 304 of the Clean Water Act that set the concentrations of pollutants which are considered adequate to protect human health based on water and fish ingestion and to protect aquatic life. Federal ambient water quality criteria may be relevant and appropriate to CERCLA cleanups based on the uses of a water body.	The designated uses for Little Elk Creek and the wetlands at the Site include protection of aquatic life and wildlife, water contact recreation and fishing ("Use I"). Maryland's SWQS for this use are considered "applicable." However, due to the close proximity of residential wells along Little Elk Creek, the Federal Ambient Water Quality Criteria (AWQC) for consumption of fish and drinking water will be considered "relevant and appropriate" for Little Elk Creek.
	Maryland - Regulations of Water Supply, Sewage Disposal, and Solid Waste; Well Construction		Applicable		
	Definitions	COMAR 26.04.04.02			
	Construction	COMAR 26.04.04.07		Contains specific standards for construction and maintenance of monitoring wells.	Substantive standards are applicable to monitoring wells. The regulation is also applicable to injection type wells which may be used to deliver treatment material.
	Abandonment Standards	COMAR 26.04.04.11		Contains specific standards for well abandonment.	Substantive standards are applicable to extraction and monitoring wells.
	Sanitary Landfills--General	COMAR 26.04.07.04 C(5)	Relevant and Appropriate	Establishes limitations of the types of material that can be used as clean-fill.	The construction debris created from the demolition of the existing structures will be left on Site and placed under the engineered cap. No permit will be required.
	Final Cover Material and Grading/Drainage	COMAR 26.04.07.10 COMAR 26.04.07.19 E(5),(6)	Relevant and Appropriate	Contains specific standards for cap cover material and grading/drainage design.	Substantive standards are applicable to construction of the engineered low permeability protective cover over shallow site soils.

	ARAR or TBC	Legal Citation	Classification	Summary of Requirement	Further Details Regarding ARARs in the Context of the Selected Remedy
	Closure	COMAR 26.04.07.21 B, D, E	Relevant and Appropriate	Contains specific standards for cap design.	Substantive standards are applicable to construction of the engineered low permeability protective cover over shallow site soils.
	Post-Closure Monitoring and Maintenance	COMAR 26.04.07.22 A, B, C	Relevant and Appropriate	Contains specific standards for monitoring and maintenance of cap.	Substantive standards are applicable to post-closure monitoring and maintenance of cap.
	Maryland - Board of Well Drillers: General Regulations		Applicable		Applies to all well drilling during OU 1 activities.
	Definitions	COMAR 26.05.01.01			
	Prohibitions	COMAR 26.05.01.02		Prohibits well drilling by any person without a license, unless an exception in subsection B applies.	
	Maryland - Waterworks and Systems Operators		Applicable	Requires certification of wastewater treatment operators by the State Board of Waterworks and Waste Systems Operators.	Applies to the ongoing operation of the ground water treatment plant.
	Definitions	COMAR 26.06.01.01			
	Classification of Facilities	COMAR 26.06.01.03			
	Certification	COMAR 26.06.01.05		Requires certification of individuals practicing as operators or superintendents of a waste water treatment plant.	
	Types of Certificates and Certification Requirements	COMAR 26.06.01.06			

Table 9 - Spectron Superfund Site ARARs
Contaminated Shallow Soils, Operable Unit 1

Record of Decision , September 2004

	ARAR or TBC	Legal Citation	Classification	Summary of Requirement	Further Details Regarding ARARs in the Context of the Selected Remedy
	Maryland - Water Pollution: Water Quality		Applicable and /or Relevant and Appropriate in some circumstances as discussed under "Further Details"	These are criteria to maintain surface water quality.	Little Elk Creek is a surface water of the State of Maryland and, pursuant to COMAR 26.08.02.07F(5), it is designated for Use I . Therefore, all criteria applicable to a discharge to a Use I surface water must be met by any point source discharges from the project. In addition, criteria for discharge into surface water designated Use I-P must be met (see discussion one box below).
		COMAR 26.08.02.02		Defines designated uses.	Use I: Water Contact Recreation, and Protection of Aquatic Life (Applicable) This use designation includes waters which are suitable for: (a) water contact sports; (b) play and leisure time activities where individuals may come in direct contact with the surface water; (c) fishing; (d) the growth and propagation of fish (other than trout), other aquatic life, and wildlife; (e) agricultural water supply; and (f) industrial water supply. Use I-P: Water Contact Recreation, Protection of Aquatic Life, and Public Water Supply. (Relevant and Appropriate) This use designation includes all uses under Designation I plus use as a public water supply. This designation is considered relevant and appropriate because of the close proximity of residential wells along Little Elk Creek down stream of the Site. These drinking water wells may be pulling contaminated water from the Creek into the wells.
		COMAR 26.08.02.03		Provide qualitative criteria for discharges to surface waters.	The ground water treatment plant discharge and any point source discharge from the construction zone shall meet the surface water quality criteria for fresh water streams and rivers and the general water quality criteria.
		COMAR 26.08.02.03-1.B		Establishes boundaries for fresh water, estuarine and salt water boundaries.	Little Elk Creek is within a fresh water boundary.
		COMAR 26.08.02.03-2 A & G		Provides numerical criteria and describes where the criteria apply.	Specific criteria for listed toxic substances must be met for any point source discharge.

	ARAR or TBC	Legal Citation	Classification	Summary of Requirement	Further Details Regarding ARARs in the Context of the Selected Remedy
		COMAR 26.08.02.03-3 A		Requires that water designated for certain uses meet certain criteria.	Surface waters designated for "Use I" must meet specified biological criteria (fecal coliform), dissolved oxygen, temperature, pH, turbidity, and chemical-specific criteria. Discharge from ground water treatment plant and any point source discharge from the construction zone must meet these criteria.
		COMAR 26.08.02.05		Describes how mixing zones can be used in calculating discharge concentrations.	The allowable mass rate and concentration of the treated ground water and of any water discharged from any point source at the construction zone will take the mixing zone requirements allowable under the regulation into account.
		COMAR 26.08.02.07		Requires that the surface water be protected according to its designated use and that any stream segment not listed in COMAR 26.08.02.08 is designated Use I.	Little Elk Creek is designated Use I. Any discharge concentrations and mass loadings shall protect Little Elk Creek for Use I designated uses.
	Maryland - Obstructing Passage of Fish Prohibited.	Maryland Code (statute) - Title 4 of Natural Resources Article, § 4-501	Applicable	Provides that an obstruction may not be placed at the mouth of any creek or across any stream so as to impound any fish and prevent its free passage to and from the water or its free access up and down the stream.	The continued maintenance and operation of the Ground Water Containment System shall comply with this requirement.
	Maryland - Water Pollution; Discharge Limitations		Applicable		
		COMAR 26.08.03.01		Describes which discharges are permitted and which are not, and sets standards for allowable discharges.	The substantive standards of these requirements shall be met by the discharge from the ground water treatment plant and any point source discharges from the construction zone.
		COMAR 26.08.03.07 D and E		Describes when discharges must be monitored and when the State may grant a temporary modification from one or more effluent limitations based on water quality criteria for toxic substances.	The substantive standards of this requirement shall be met, but no permit will be required. Any discharges from the ground water treatment plant shall be monitored for biotoxicity unless EPA determines at a future date that this is not necessary to protect the environment.
	Maryland - Water Pollution: Discharge Permit Limits	COMAR 26.08.04.02-1 A and D	Applicable	Describes general types of conditions to be included in a permit and describes mixing zone calculations.	Any point source discharge shall meet all substantive criteria, but no permit will be required.
	Maryland - Water Pollution: Monitoring	COMAR 26.08.04.03A	Applicable	An authorized discharge shall be subject to any monitoring requirements deemed necessary.	EPA will determine appropriate monitoring requirements for the ground water treatment plant discharge and any point source discharge from the construction zone based on all available information. This shall include, but not be limited to, sampling of any contaminant that may be present.

Table 9 - Spectron Superfund Site ARARs
Contaminated Shallow Soils, Operable Unit 1
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	ARAR or TBC	Legal Citation	Classification	Summary of Requirement	Further Details Regarding ARARs in the Context of the Selected Remedy
	Maryland - Nontidal Wetlands: Mitigation		Applicable		The substantive standards of this regulation are applicable to all Site activities that could affect wetlands.
	Mitigation for Regulated Activities	COMAR 26.23.04.02		States that all necessary steps shall be taken to first avoid adverse impacts and then minimize losses of nontidal wetlands. If losses are not avoidable, mitigation is required.	
	Mitigation Standards	COMAR 26.23.04.03		Requires a minimum replacement ratio of 1:1 on an acreage basis plus additional replacement for lost value.	
	Maryland - Non-tidal Wetlands: General and Permit Application and Processing		Applicable	Provides criteria for the following activities if undertaken in a non-tidal wetland or its buffer zone: (i) removal, excavation or dredging of any materials, (ii) changing existing drainage characteristics, sedimentation patterns, flow patterns, or flood retention characteristics, (iii) disturbance of the water level or water table by drainage, impoundment or other means, (iv) dumping, discharging of, or filling with material, or placing of obstructions, (v) grading or removal of material that would alter existing topography, or (vi) destruction or removal of plant life that would alter the character of a nontidal wetland.	There are non-tidal wetlands adjacent to Little Elk Creek. Any activities in these wetlands or their buffer zone that involve the following must comply with the substantive standards of these regulations: (i) removal, excavation or dredging of any materials, (ii) changing existing drainage characteristics, sedimentation patterns, flow patterns, or flood retention characteristics, (iii) disturbance of the water level or water table by drainage, impoundment or other means, (iv) dumping, discharging of, or filling with material, or placing of obstructions, (v) grading or removal of material that would alter existing topography, or (vi) destruction or removal of plant life that would alter the character of a non-tidal wetland.
		COMAR 26.23.01.01			
		COMAR 26.23.01.02			No permit would be required for the selected remedial action.
		COMAR 26.23.01.04		Describes the nontidal wetland areas for which the buffer is expanded to 100 feet.	The OU 1 activities shall comply with this requirement.
		COMAR 26.23.02.04		Describes how the State reviews non-tidal wetland permits.	All substantive criteria shall be complied with, but no permit will be required.

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	ARAR or TBC	Legal Citation	Classification	Summary of Requirement	Further Details Regarding ARARs in the Context of the Selected Remedy
		COMAR 26.23.02.06		Subsection 26.23.02.06A provides substantive criteria for meeting Section 26.232.02.04A(3)'s requirement that a regulated activity cannot degrade State waters. Subsection 26.23.02.06B requires any regulated activity to be consistent with any approved comprehensive watershed management plan.	The substantive criteria shall be met.
	Maryland - Water Management: Construction on Non-tidal Waters and Floodplains		Applicable	Governs construction, reconstruction, repair, or alteration of a dam, reservoir, or waterway obstruction or any change of the course, current, or cross section of a stream or body of water within the State including any changes to the 100-year frequency floodplain of free-flowing waters.	All substantive criteria of this regulation shall be complied with, but no permit will be required.
		COMAR 26.17.04.01			
		COMAR 26.17.04.02			
		COMAR 26.17.04.04 C, D, E, F		Identifies requirements for construction in non-tidal waters and floodplains.	Some temporary construction may be required in the small intermittent stream near the Dam.
		COMAR 26.17.04.07 B(3-7)		Describes requirements for projects that encroach on a floodplain.	OU 1 area is partially located within a floodplain.
		COMAR 26.17.04.08 B(1-3), C(1-2), and E(1-2)		Describes temporary sediment control device design criteria for construction, access crossings, and storm drain outfalls in stream channels and/or floodplains.	Some work in the small intermittent stream adjacent to Little Elk Creek may be required.
	Criteria for Evaluating Applications	COMAR 26.17.04.11 B(3)		States that generally it is contrary to public interest to block free passage of fish.	EPA has determined that it is contrary to public interest to block free passage of fish at this Site.

Table 9 - Spectron Superfund Site ARARs
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	ARAR or TBC	Legal Citation	Classification	Summary of Requirement	Further Details Regarding ARARs in the Context of the Selected Remedy
		COMAR 26.17.04.11 B(5)		States that construction in non-tidal wetlands is not in the public interest. If construction is unavoidable, measures must be taken to mitigate, replace or minimize the loss of aquatic or terrestrial habitat. Also provides restrictions for construction during certain periods of the year in trout waters and water with anadromous fish runs.	
		COMAR 26.17.04.11 B(6)		Prohibits projects that increase the risk of flooding to other property owners.	Steps shall be taken to avoid flood impacts to homes.
		COMAR 26.17.04.11 B(7)		Prohibits construction or substantial improvement to any residential, commercial or industrial structure in the 100-year floodplain and below the 100-year flood elevation.	Any structures which may be constructed must be built above the 100-year flood elevation.
		COMAR 26.17.04.11 E		Allows the State to grant variances under certain criteria.	
	Federal Regulation of Activities in or Affecting Wetlands	40 CFR 6.302(a) and Part 6 Appendix A	Applicable	Sets forth EPA requirements for carrying out provisions of Executive Order 11990 (Protection of Wetlands). No activity that adversely affects a wetland shall be permitted if a practicable alternative that has less effect is available. If there is no other practicable alternative, impacts must be minimized and/or mitigated.	The substantive standards of this regulation are applicable to all Site activities that could affect wetlands. EPA has determined that there is no practicable alternative that has less effect. Efforts to minimize and mitigate, including potential off-site mitigation, shall take place in order to have no net loss of wetland habitat and value.
	Federal Regulation of Activities in or Affecting Floodplains	40 CFR Section 6.302(b) and Part 6 Appendix A	Applicable	Sets forth EPA requirements for carrying out provisions of Executive Order 11988 (Floodplain Management). No activity that adversely affects a floodplain shall be permitted if a practicable alternative that has less effect is available. If there is no other practicable alternative, impacts must be mitigated to the extent possible.	The substantive standards of this regulation apply to all activities at the Site, because the Site is in a floodplain. The selected remedy shall evaluate this issue in detail and determine if the Ground Water Containment System complies with this regulation to determine possible impacts to the 100-year or 500-year floodplain. Any ground water treatment plant expansion shall be built in accordance with the standards and criteria of the regulations promulgated pursuant to the National Flood Insurance Program.

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	ARAR or TBC	Legal Citation	Classification	Summary of Requirement	Further Details Regarding ARARs in the Context of the Selected Remedy
	Federal Fish & Wildlife Coordination Act	16 U.S.C. 661 *et seq* 40 CFR 6.302(g)	Applicable	Requires Federal agencies involved in actions that will result in the control or structural modification of any natural stream or body of water for any purpose, to take action to protect the fish and wildlife resources which may be affected by the action. Consultation with the US Fish and Wildlife Service and the appropriate State agency is required to ascertain the means and measures necessary to mitigate, prevent, and compensate for project-related losses of wildlife resources and to enhance the resources.	Substantive requirements of the law/regulation shall be met; the US Fish and Wildlife Service and the Maryland Department of Natural Resources have been consulted.
	Federal Endangered Species Act of 1978	16 U.S.C. § 1531 <u>et seq</u>.	Relevant and Appropriate	Requires federal agencies to ensure that any action authorized by an agency is not likely to jeopardize the continued existence of any endangered or threatened species or adversely affect its critical habitat.	The substantive standards of this regulation apply to all activities at the Site. While no endangered species have been noted during surveys, the opportunity for endangered species to be present may be possible due to the rural setting.
	Federal Coastal Zone Management Act of 1972; Coastal Zone Act Reauthorization Amendments of 1990	16 U.S.C. 1451 *et seq.* 15 CFR Part 930.17, 20, 31-33, 37(a), 39(b-d)	Applicable	Requires that Federal agencies conducting or supporting activities directly affecting the coastal zone, conduct or support those activities in a manner that is consistent with the approved appropriate State coastal zone management program.	The Spectron Site is within the coastal zone. The project shall be conducted in a manner that is consistent with the approved Maryland coastal zone management program, to the maximum extent practicable, but no procedural requirements in the regulations must be followed.
	Federal Council on Environmental Quality	40 CFR 1500.2(f)	Relevant and Appropriate	Requires use of all practicable means, consistent with the requirements of NEPA, to restore and enhance the quality of the human environment and avoid or minimize any possible adverse effects upon the quality of the human environment.	
	Maryland: Control of Noise Pollution		Applicable	Provides limits on noise levels for the protection of human health and welfare and exemptions to those limits, and specifies standards to be met by sound level meters to be used to determine compliance.	Substantive standards of these regulations shall be met at the Site property boundaries during construction and during operation of the ground water treatment plant, unless the activity in question is subject to an exemption under COMAR 26.02.03.03 B(2).
	Definitions	COMAR 26.02.03.01			
		COMAR 26.02.03.02 A(2), B(2) and COMAR 26.02.03.03A, B(2), and (D(2) and (3)			

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	ARAR or TBC	Legal Citation	Classification	Summary of Requirement	Further Details Regarding ARARs in the Context of the Selected Remedy
	Federal Clean Water Act (CWA); National Pollutant Discharge Elimination System Requirements (NPDES)	33 U.S.C. § 1251 et seq.	Applicable	Enforceable standards for all discharges to waters of the United States.	Discharge limits shall be met by the discharge from the ground water treatment plant and any point source discharge from the construction zone. Only substantive requirements shall be met and no permit shall be required.
		40 C.F.R. Part 122.1(b)(1)			
		40 C.F.R. Part 122.2			
		40 C.F.R. Part 122.29			
		40 CFR Parts 122.41(a), (d), (e), (j)(1), and (m)(1) and (4); 122.44-45; 125.1-3; and 125.100-104			
	Maryland Storm water Management		Applicable	Requires storm water management plan and contains minimum requirements for the control of storm water, to be included in ordinances adopted by local government bodies. Provides for specific minimum control requirements and design criteria for storm water management.	The substantive standards of these requirements are applicable to the remedial activities at the Site, unless such activity is exempted under COMAR 26.09.02.05 B. No permit will be required. A storm water management plan, subject to EPA approval, shall be required for this project.
	Definitions	COMAR 26.17.02.02			
		COMAR 26.17.02.05 A and B			
		COMAR 26.17.02.06 A(3)			
		COMAR 26.17.02.08			
	Federal River and Harbors Act - Section 10	33 U.S.C. Section 403	Applicable	Permitting requirements for dredging, filling, or construction within the waters of the U.S.	There may be temporary construction and minimal dredging of the small intermittent stream adjacent to Little Elk Creek. Construction activities shall meet these substantive requirements. No permit will be required.
		33 CFR Part 320.4			
		33 CFR Part 322			
		33 CFR Part 323			
		33 CFR Part 328			
		33 CFR Part 329			
	Maryland Erosion and Sediment Control		Applicable	Requires preparation of an erosion and sediment control plan for activities involving land clearing, grading and other earth disturbances and establishes erosion and sediment control criteria.	The substantive standards of these regulations shall apply to clearing, grading, and excavation activities at the Site. No permit will be required.

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	ARAR or TBC	Legal Citation	Classification	Summary of Requirement	Further Details Regarding ARARs in the Context of the Selected Remedy
	Definitions	COMAR 26.17.01.01			
		COMAR 26.17.01.05 A and B			
		COMAR 26.17.01.07 B			
		COMAR 26.17.01.08 A and B			
	Maryland - Water Appropriation and Use		Applicable	Establishes criteria and terms for persons appropriating or using water.	The substantive standards of these regulations shall apply since ground water will be removed as part of the containment system. No permit will be required. The containment system shall not have an area-wide impact on the water table since the collection system is a passive system and the treated ground water is being discharged back into the Creek.
	Definitions	COMAR 26.17.06.01			
		COMAR 26.17.06.03			
		COMAR 26.17.06.05			
	Maryland - Air Quality: General Emission Standards, Prohibitions		Applicable	Provides air quality standards, general emission standards and restrictions for air emissions from articles, machines, equipment, etc. capable of generating, causing, or reducing emissions.	Any equipment or construction capable of generating, causing or reducing emissions (e.g., excavation/dredging; air stripper) shall meet these substantive requirements. No permit will be required.
	Definitions	COMAR 26.11.06.01			
		COMAR 26.11.06.02			
	Particulate Matter	COMAR 26.11.06.03			
	Volatile Organic Compounds	COMAR 26.11.06.06			
	Nuisance	COMAR 26.11.06.08			
	Odors	COMAR 26.11.06.09			
	Maryland - Air Quality: Toxic Air Pollutants		Applicable	Requires emissions of Toxic Air Pollutants ("TAPs") from new and existing sources to be quantified (also describes methods of quantification); establishes ambient air quality standards and emission limitations for TAP emissions from new sources; requires best available control technology for toxics for new sources.	The ground water treatment plant shall continue to be operated in a manner that meets the emission standards. No permit will be obtained (only the substantive standards shall be complied with). The continued operation of the treatment plant shall be performed in such a manner as to comply with the substantive requirements of these regulations.
		COMAR 26.11.15.01			
		COMAR 26.11.15.03			
		COMAR 26.11.15.04 A and C			
		COMAR 26.11.15.05			
		COMAR 26.11.15.06			
		COMAR 26.11.15.07			

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Contaminated Shallow Soils, Operable Unit 1

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	ARAR or TBC	Legal Citation	Classification	Summary of Requirement	Further Details Regarding ARARs in the Context of the Selected Remedy
		COMAR 26.11.16.03			
		COMAR 26.11.16.05			
		COMAR 26.11.16.06			
	Toxic Air Pollutants for Existing Sources	COMAR 26.11.16.07			
	Levels Used to Review Ambient Impacts	COMAR 26.11.16.09			
	Federal - Control of Air Emissions from Air Strippers at Superfund Ground water Sites	OSWER Directive 9355.0-28, June 15, 1989	To Be Considered	This policy guides the decision of whether additional controls (beyond those required by statute or regulation) are needed for air strippers at ground water sites.	This policy would be considered in determining the necessary emission controls. Sources most in need of additional controls are those with emissions rates in excess of 3 lbs./hour or a potential rate of 10 tons/year of total VOCs.
	Federal Resource Conservation and Recovery Act of 1976; Hazardous and Solid Waste Amendments of 1984	42 U.S.C. §6901 et seq.	Applicable	Regulates the management of hazardous waste, to ensure the safe disposal of wastes, and to provide for resource recovery from the environment by controlling hazardous wastes “from cradle to grave.”	Hazardous waste in the form of DNAPL may be recovered from the ground water treatment plant or monitoring wells and then temporarily stored on-site until it can be properly disposed of off-site. Therefore, in regard to the handling and disposal of hazardous waste on-site these regulations shall be considered applicable.
	Maryland - Disposal of Controlled Hazardous Substances		Applicable		
		COMAR 26.13.01.03		Provides definitions for when hazardous waste management requirements are triggered.	These criteria and definitions shall be used in determining whether or not materials are to be handled as hazardous waste.
		COMAR 26.13.02.01-.06 COMAR 26.13.02.11-15A		Contains criteria and lists for identifying characteristic and listed wastes.	Use to determine if any materials handled during OU 1 construction activities (for example, the extracted ground water, ground water treatment waste, and excavated soils) are defined as hazardous waste, thus triggering on-site storage and disposal requirements.
		COMAR 26.13.03.01 - .06	Applicable	Establishes standards for generators of hazardous wastes.	Requires making determination of material as hazardous or non-hazardous prior to on-site storage or disposal.

	ARAR or TBC	Legal Citation	Classification	Summary of Requirement	Further Details Regarding ARARs in the Context of the Selected Remedy
	Standards Applicable to Transporters of Hazardous Waste	COMAR 26.13.04.01 - .04	Applicable	Establishes standards for transporters of hazardous wastes.	
	Accumulation Limit	COMAR 26.13.03.01 B(1) and (6) COMAR 26.13.03.05 E	Applicable	Establishes standards for handling and storage of hazardous waste.	Wastes that are hazardous waste pursuant to COMAR 26.13.02 and that are to be disposed of off-site (such as any ground water treatment sludge) shall be managed (while onsite) in accordance with the substantive standards in COMAR 26.13.03.05 E.
		COMAR 26.13.05.01A(2), 26.13.05.09, 26.13.05.10-1, 2, 4A(1), B, C & D, 26.13.05.10-6A(1)-(5), (7) & (8), 26.13.05.10-7A, 26.13.05.12			Applies to all OU 1 activities that involve handling hazardous waste. Hazardous Waste is handled in the ground water treatment plant.
	Landfills	COMAR 26.13.05.14J(1)(a)-(e) and J(2)(a)-(d) except that the reference to "post closure requirements contained in Regulation .07G-J" found in COMAR 26.13.05.14J(2) shall not be read to require compliance with any additional requirements not specifically stated herein.		Applies to owners and operators of facilities that dispose of hazardous waste in landfills.	Specific cap requirements apply to the cap. This landfill requirement applies since stockpiled contaminated creek sediments, a former lagoon, debris pile waste, and building construction debris will be placed under the cap.
	Federal - Identification and Listing of Hazardous Wastes	40 CFR Part 261	Applicable	Provides definitions for when hazardous waste management requirements are triggered. Contains criteria and lists for identifying characteristic and listed wastes.	Use to determine if any materials handled during the OU 1 construction activities (for example, the extracted ground water, ground water treatment waste, and excavated soils) are defined as hazardous waste, thus triggering on-site storage and disposal requirements.
	Federal - Standards Applicable to Generators of Hazardous Waste	40 CFR Sections 262.11	Applicable	Establishes standards for generators of hazardous wastes.	Requires the determination of material as hazardous or non-hazardous prior to on-site storage or disposal.
	Federal - Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities (TSDFs)	40 CFR Part 264	Applicable	Regulations for owners and operators of TSDFs which define acceptable management of hazardous wastes.	Applicable federal requirements that are not part of Maryland's authorized State RCRA program shall be implemented in regard to all OU 1 construction activities that involve handling hazardous waste.
		40 CFR Part 264.10 -.19			
		40 CFR Part 264.30 - .37			

Table 9 - Spectron Superfund Site ARARs
Contaminated Shallow Soils, Operable Unit 1
Record of Decision , September 2004

	ARAR or TBC	Legal Citation	Classification	Summary of Requirement	Further Details Regarding ARARs in the Context of the Selected Remedy
		40 CFR Part 264.50 - .56			
		40 CFR Part 264.111 - Closure performance standards 40 CFR 264.114 - Disposal or decontamination of equipment, structures and soils			
		40 CFR 264.170-179			
	(Subpart J)	40 CFR 264.190-200 Only applicable for onsite treatment systems and temporary storage tanks containing hazardous wastes.			
		40 CFR 264.220-223, 226-230			
		40 CFR 264.250-254, 256-259			
		40 CFR 264.1030-1036			
		40 CFR 264.1050-1063			
		40 CFR 264.1080-1088			
	Containment Buildings (Subpart DD)	40 CFR 264.1100-1102			
		40 CFR 264.300 - .317	Relevant and Appropriate	Contains requirements for landfill cap.	Only those cap requirements which are more stringent than the cap requirements under Maryland's authorized RCRA program.
	RCRA* Land Disposal Restrictions	40 CFR Part 268	Applicable	Restrictions on land disposal of hazardous wastes.	If sediments are found to be hazardous waste (triggering the requirements of the land ban regulations), treatment shall be required prior to placement.
	National Historic Preservation Act of 1966, as amended	36 C.F.R. §§ 800.4(b-c), 800.4(e), 800.5(e), 800.9	Applicable	Requires remedial action to take into account effects on properties included on or eligible for the National Register of Historic Places.	Maryland Division of Historical and Cultural Programs has requested that a Determination of Eligibility (DOE) be provided since the Site is located in Little Elk Creek Historic District which is National Register eligible. A DOE shall be prepared. The final determination will be based on this DOE report by the Division prior to start of a remedial action. If cultural resources either on or eligible for the National Register of Historic Places are present, steps shall be taken to avoid, minimize or mitigate any adverse impacts. Only the substantive requirements will be met.

*Resource Conservation and Recovery Act of 1976; Hazardous and Solid Waste Amendments of 1984

Table 10
Alternative Cost Summary -

Remedial Alternative	Description	Capital Cost	Annual Operation & Maintenance Cost (O & M)	Total O & M Present Worth Cost (5%, 30 Yrs)	Total Present Worth Cost (5%, 30 Yrs)
1	No Action	$0	$0	$0	$0
2	Phytoremediation with Soil Cover	$2,119,581	$445,000*	$7,031,000	**$9,150,581**
3	In-Situ Treatment with Engineered Cover	$2,029,148	$472,333 *	$7,462,867**	**$9,492,014**
4	Excavation and Off-Site Disposal and a Soil Cover	$8,649,829	$375,000*	$5,925,000	**$14,574,829**
5	Soil Vapor Extraction with Engineered Cover	$3,784,648	(1-10yr for SVE only) - $590,000* (1-30yr GWTS/Cap O &M) $395,000*	(1-10yr for SVE only) $4,513,500 (1-30yr GWTS/Cap O &M) $6,241,000	**$14,539,148**

* O & M costs include $360,000 for Ground Water Containment System operation

** See Table 10a for a detailed breakdown of Remedial Alternative 3. 3. The cost stated in the Proposed Remedial Action Plan (PRAP) dated June 20, 2003, for alternative 3, "In-Situ Treatment with Engineered Cover System and Institutional Controls" differs slightly from the costs stated here due to refinements in the estimate. This increase is well within the estimate error range and did not impact the determination as to the preferred alternative.

TABLE 10a
SELECTED REMEDY
ESTIMATED COST

In-Situ Treatment with Engineered Cover and Institutional Controls

Capital Costs

	Item Description	Quantity	Unit	Unit Cost	Item Cost
I.	***Institutional Controls***	1	lump	$50,000.00	$ 50,000
II.	***Site Preparation***				
	Mobilization/Setup	1	lump	$80,000.00	$ 80,000
	Erosion and Sediment Controls[1]	1	lump	$50,000.00	$ 50,000
	Subtotal				$ 130,000
III.	***Demolition***				
	Demolition and Crushing/Grading Debris	1	lump	$380,000.00	$ 380,000
	Relocating and Grading of Creek Sediments/Soil	3,000	cy	$4.00	$ 12,000
	Subtotal				$ 392,000
IV.	***Engineer Cover System***				
	Sub-base layer (6" General Fill)	2,120	cy	$15.00	$ 31,800
	Geosynthetic Clay Liner	131,000	sf	$0.70	$ 91,700
	60 mil HDPE Liner	131,000	sf	$0.80	$ 104,800
	Geonet Drainage Layer	131,000	sf	$0.40	$ 52,400
	Protective Geotextile	131,000	sf	$0.40	$ 52,400
	18" General Fill[2]	7,260	cy	$15.00	$ 108,900
	6" Topsoil[2]	2,410	cy	$25.00	$ 60,250
	Mulching/Seeding[2]	131	1,000 sf	$65.00	$ 8,515
	Subtotal				$ 510,765
	Direct Construction Total (DCT)				$ 1,082,765
	Indirect Construction (20% of DCT)				$ 216,553
	Construction Total				**$ 1,299,318**
	Predesign Investigation (Total), including:				$ 255,000
	Supplemental Overburden Investigation				
	Building Survey				
	Creek Sediments/Soil Characterization				
	Design (10% of Construction Total)				$ 129,932
	Permitting/Legal (5% of Construction Total)				$ 64,966
	Regulatory Submittals (10% of Construction Total)				129,932
	Construction Phase Engineering Services	5	month	$30,000.00	$ 150,000
	Projected Opinion of Probable Capital Cost				**$ 2,029,148**

TABLE 10a
SELECTED REMEDY
ESTIMATED COST

In-Situ Treatment with Engineered Cover and Institutional Controls

Annual Costs - 30 Year

		Quantity	Unit	Unit Cost	Annual Costs
I.	**Operation and Maintenance Costs**				
	GW Treatment Plant O & M	1	yr	$360,000.00	$ 360,000
	Site Inspection[3]	4	inspections	$2,500.00	$ 10,000
	Cover Maintenance (Mowing & Repair)	3	ac	$5,000.00	$ 15,000
	Annual Progress Report	1	lump	$20,000.00	$ 20,000
	Sub Total Annual O&M Cost				$ 405,000
II	***In Situ Mass Reduction***				
	In Situ Treatability Testing (Pre-design)	1	lump	$5,333.33	$ 5,333
	Phase-in and Full-Scale Field Implementation and Operation	1	lump	$32,000.00	$ 32,000
	Miscellaeneous Appurtences	1	lump	$1,666.67	$ 1,667
	System Dismantlement	1	lump	$3,333.33	$ 3,333
	Annual O &M (sampling , reporting, maintenance)				$ 25,000
	Sub-Total: In-Situ Annual Cost (per year cost for 30 years				$ 67,333
	Total Annual O&M Cost - Present Worth Value "R"				$ 472,333
	Present Worth @ I = 5%, n = 30 yr = R [((1+i)n - 1)/i(1+i)n] = R[15.80]				**$ 7,462,867**

Total Present Worth

	Quantity	Unit	Unit Cost	Cost
Total Capital Cost				$ 2,029,148
Total Present Worth O&M Cost-30 year				$ 7,462,867
Subtotal				$ 9,492,014
Projected Opinion of Probable Cost (Present Worth)				**$ 9,492,014**

[1]Engineering estimate from previous work

[2]RS Means Building Constrction Cost Data

[3]Semi-annually and after storm events

TABLE 11
Performance Standards for
Ground Water Containment System

Volatile Organic Compounds (VOCs)			
a.	acetone (note a)	5,500	μg/l
b.	benzene	2.2	μg/l
c.	2-butanone (note a)	7,000	μg/l
d.	chlorobenzene	680	μg/l
e.	chloroethane (note b)	3.6	μg/l
f.	chloroform	5.7	μg/l
g.	1,1-dichloroethane (note a)	800	μg/l
h.	1,2-dichloroethane	0.38	μg/l
i.	1,1-dichloroethene	0.057	μg/l
j.	1,2-trans-dichloroethene	700	μg/l
k.	ethylbenzene	3,100	μg/l
l.	methylene chloride	4.6	μg/l
m.	4-methyl-2-pentanone (note a)	6,300	μg/l
n.	naphthalene (note a)	6.5	μg/l
o.	1,1,2,2-tetrachloroethane	0.17	μg/l
p.	tetrachloroethene	0.69	μg/l
q.	toluene	6,800	μg/l
r.	1,1,1-trichloroethane (note c)	200	μg/l
s.	1,1,2-trichloroethane	0.59	μg/l
t.	trichloroethene	2.5	μg/l
u.	vinyl chloride	2	μg/l
Semi-volatile Organic Compounds (SVOCs)			
v.	bis(2-chloroethyl)ether	0.03	μg/l
w.	4-chloroaniline (note a)	150	μg/l
x.	1,2-dichlorobenzene	2,700	μg/l
y.	1,4-dichlorobenzene	400	μg/l
z.	4-methylphenol (note a)	180	μg/l
aa.	1,2,4-trichlorobenzene(note c)	70	μg/l

Notes
a. Value is level in drinking water that results in a Hazard Index of 1.0.

b. Value is level in drinking water that results in a carcinogenic risk of 1 x 10^{-6}.

c. Value is Maryland State Water Quality Standard for protection of drinking water.

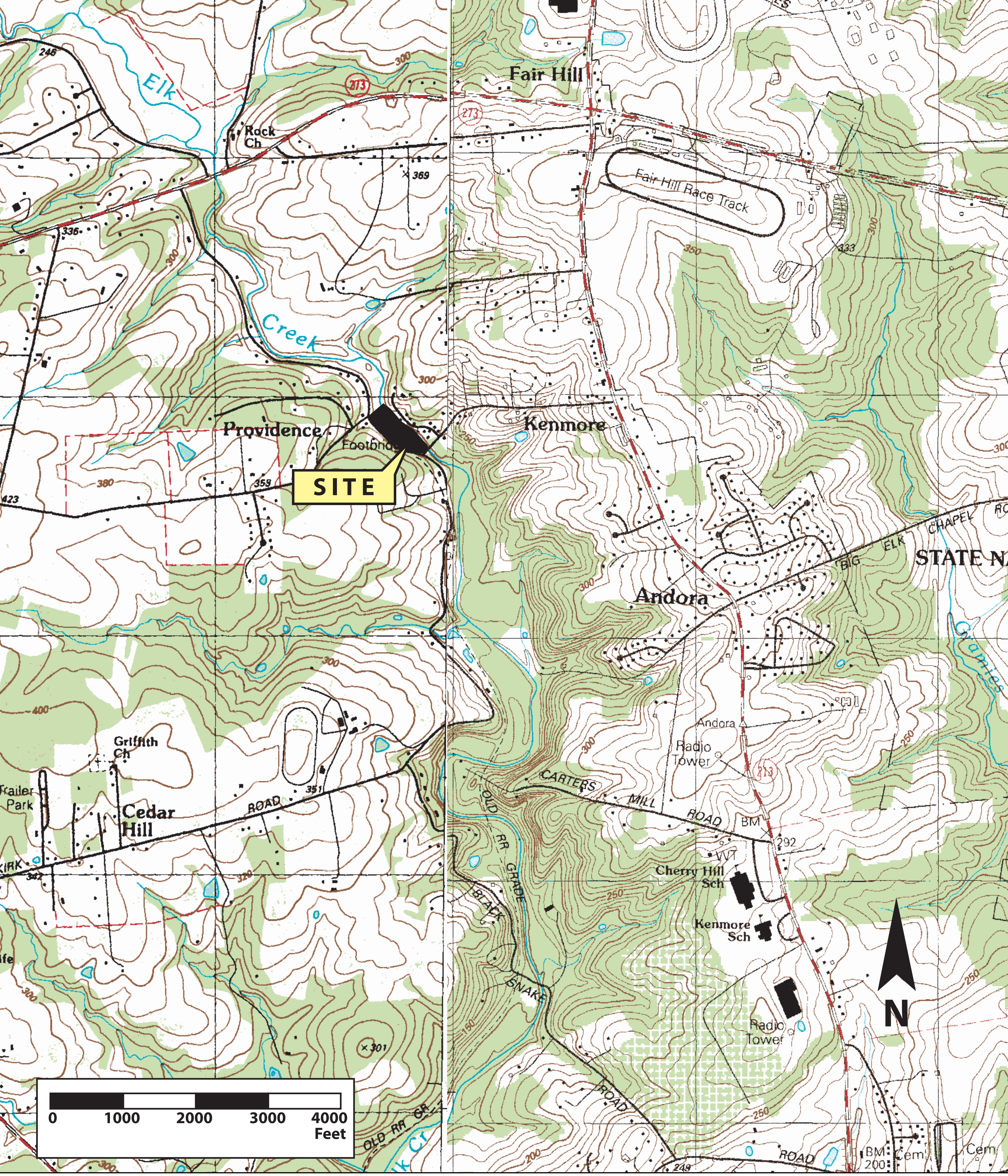

Figure 1
Site Location Map
Galaxy/Spectron Site
Elkton, Maryland

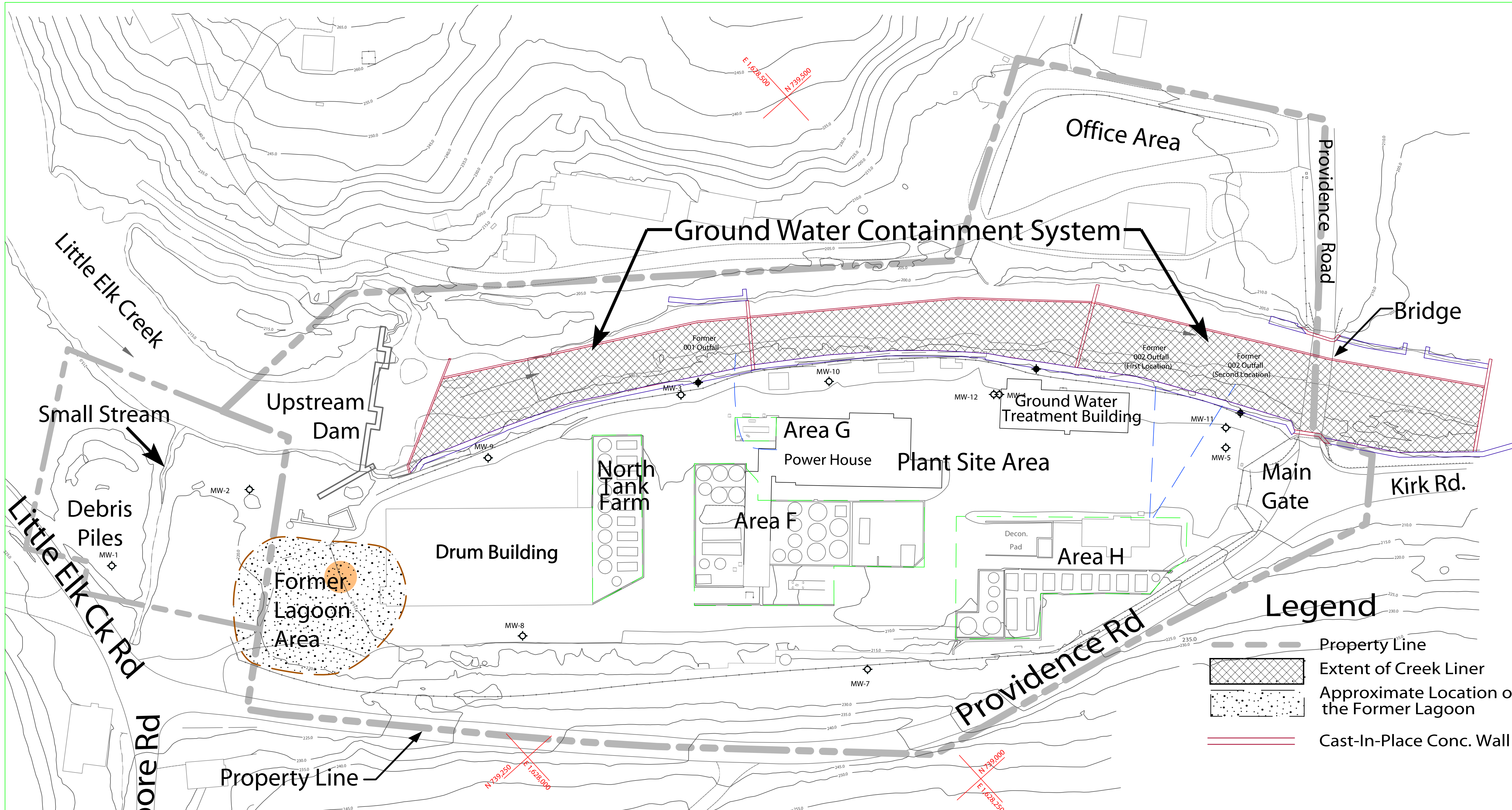

Figure 2
Site Map and Approximate Locations of Current and Historic Features
Spectron Inc Site
Elkton, Maryland

Note:
Aboveground tasks associated with process area F and H have been removed

ERM, INC.

-1F

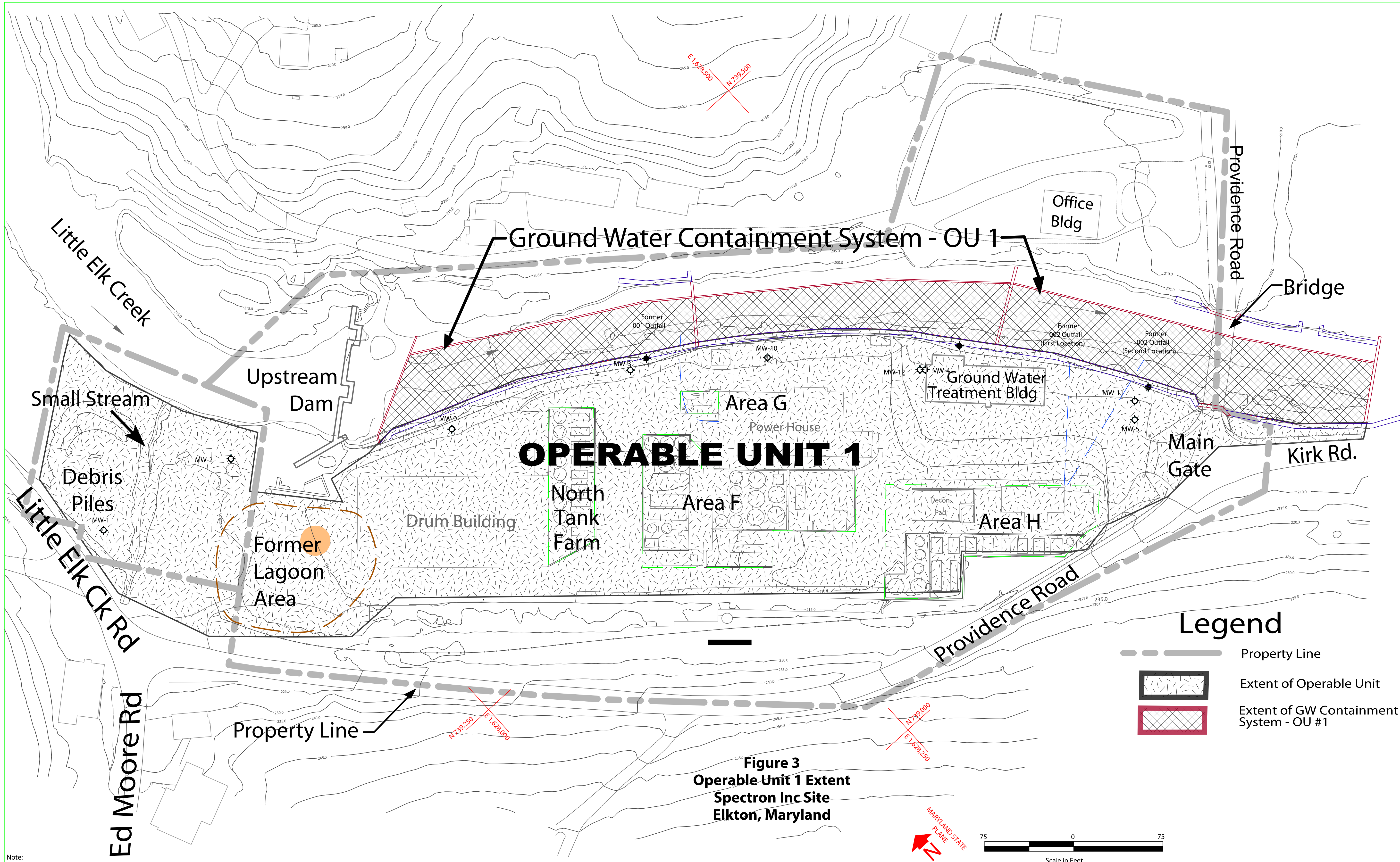

Figure 3
Operable Unit 1 Extent
Spectron Inc Site
Elkton, Maryland

Note:
Aboveground tasks associated with process area F and H have been removed

ERM, INC.

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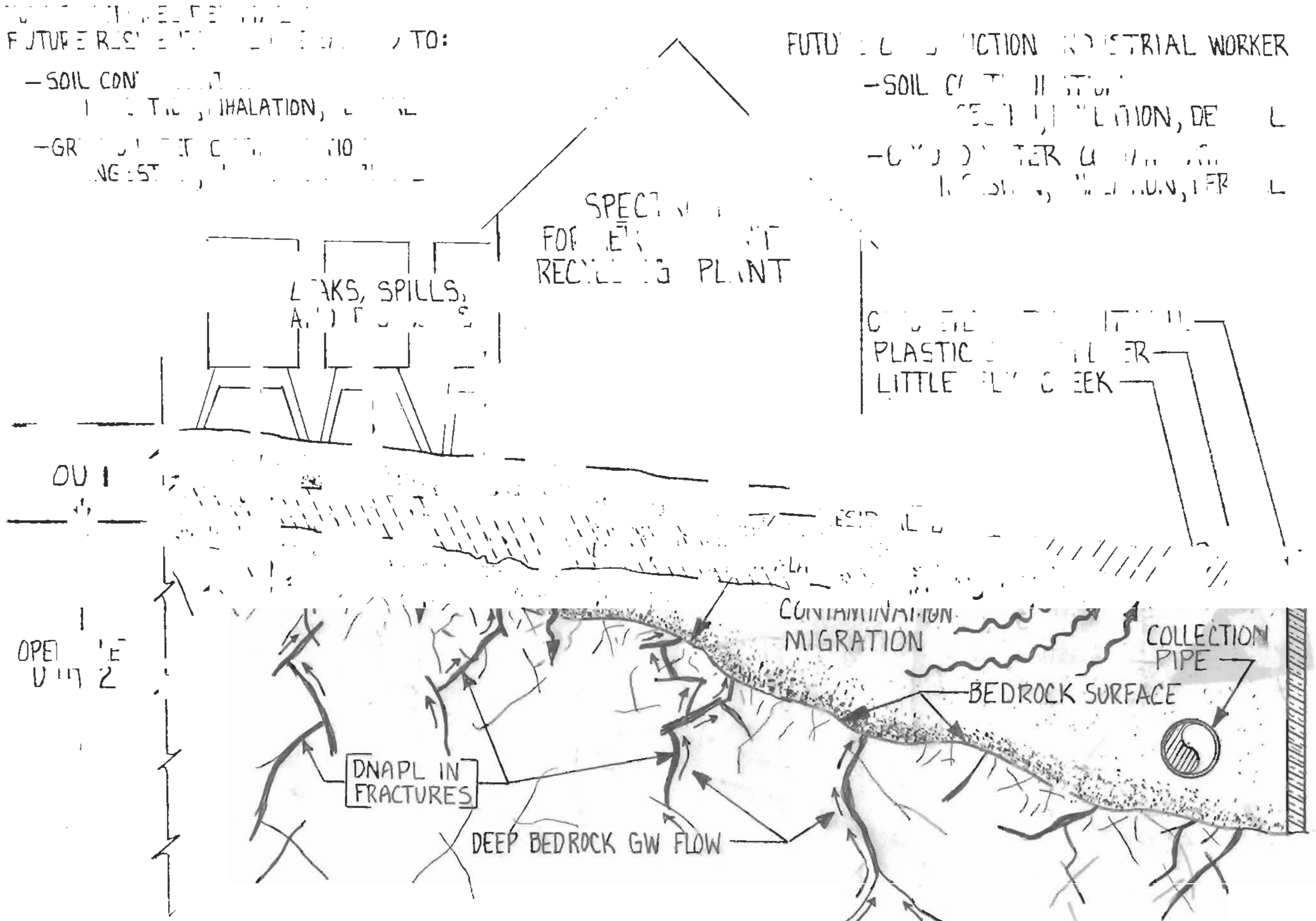
FIG
CONCEPTUAL SITE M EL



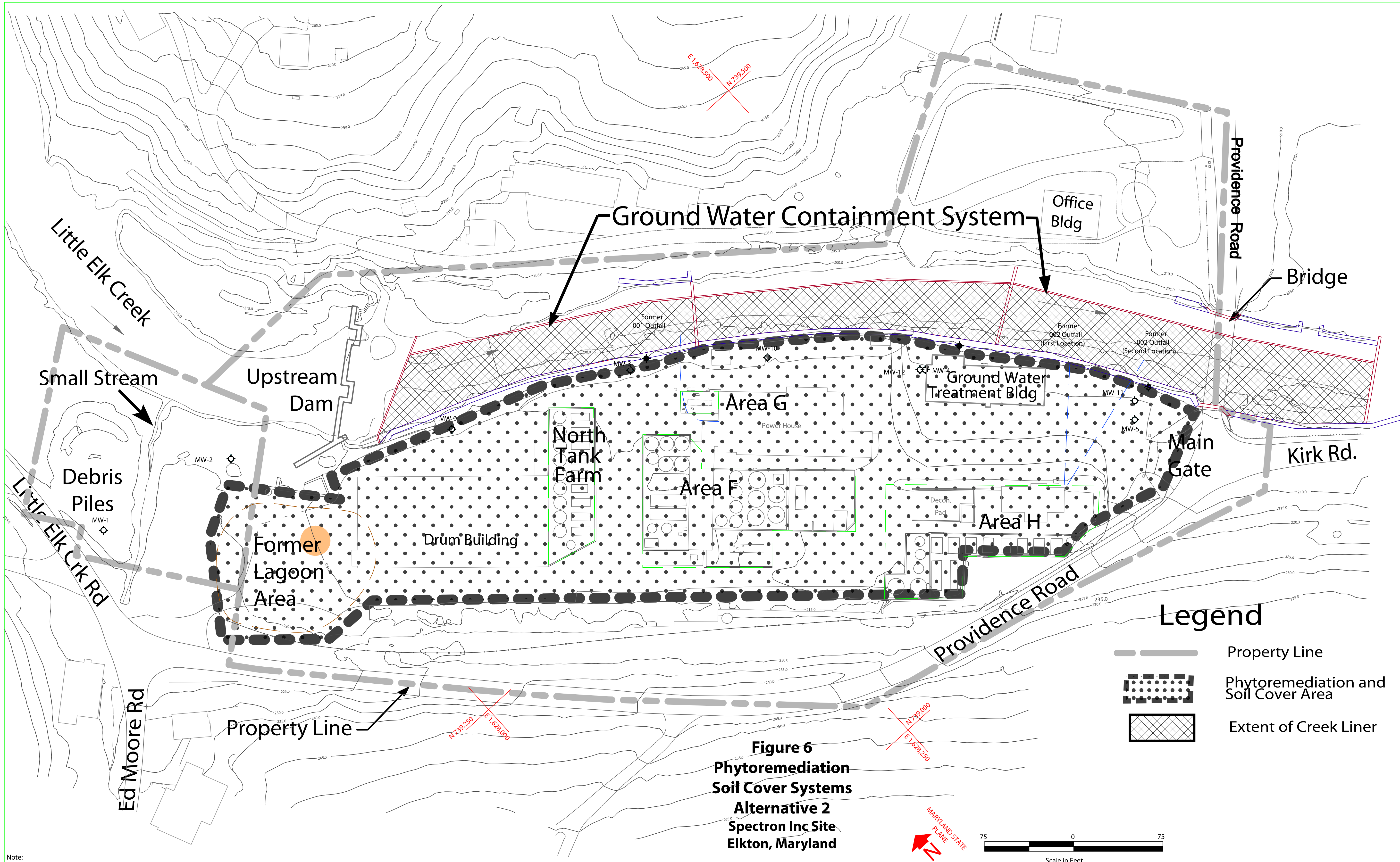


Figure 6
Phytoremediation
Soil Cover Systems
Alternative 2
Spectron Inc Site
Elkton, Maryland

Note:
Aboveground tasks associated with process area F and H have been removed

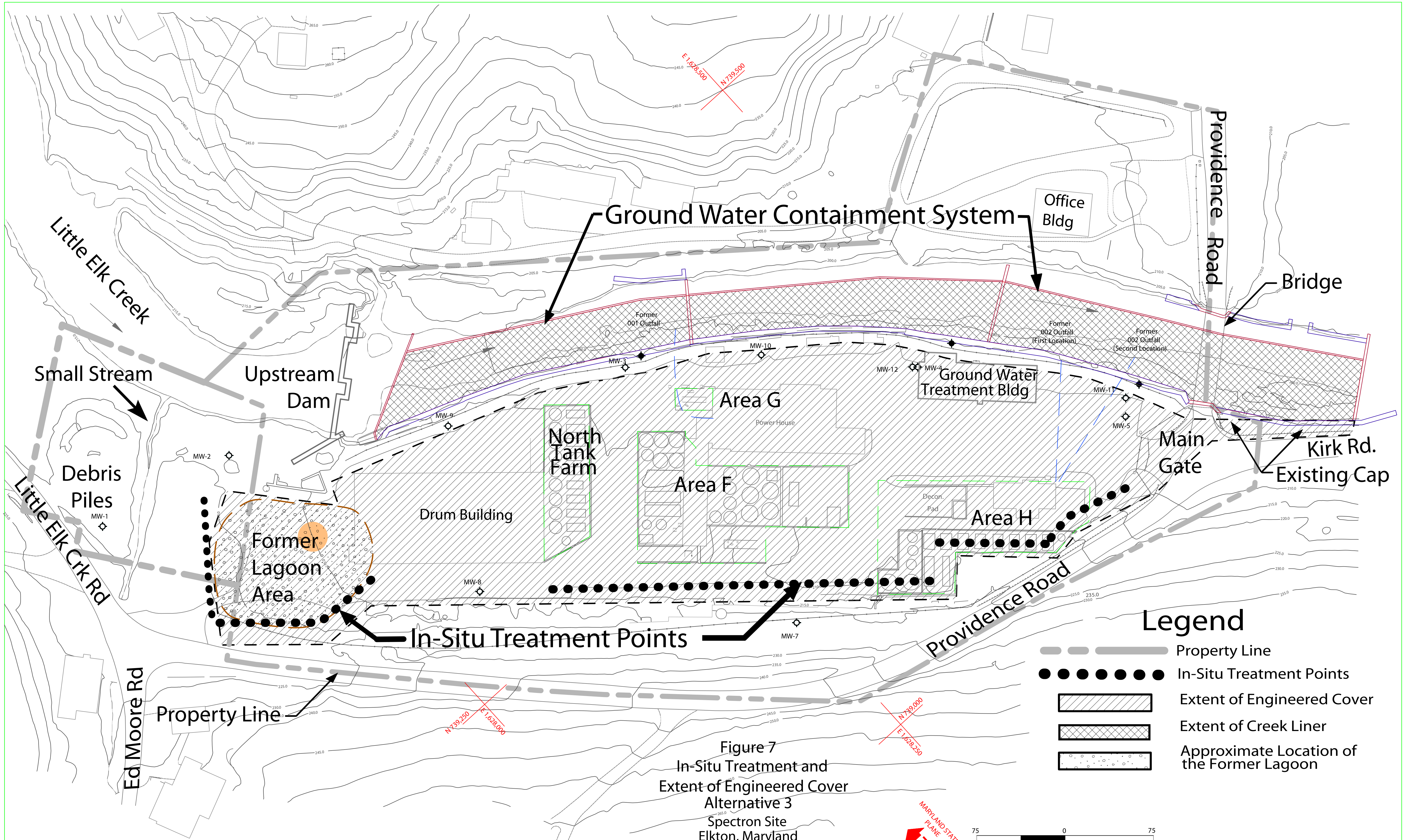


Figure 7
In-Situ Treatment and
Extent of Engineered Cover
Alternative 3
Spectron Site
Elkton, Maryland

Note:
Aboveground tasks associated with process area F and H have been removed

ERM, INC.

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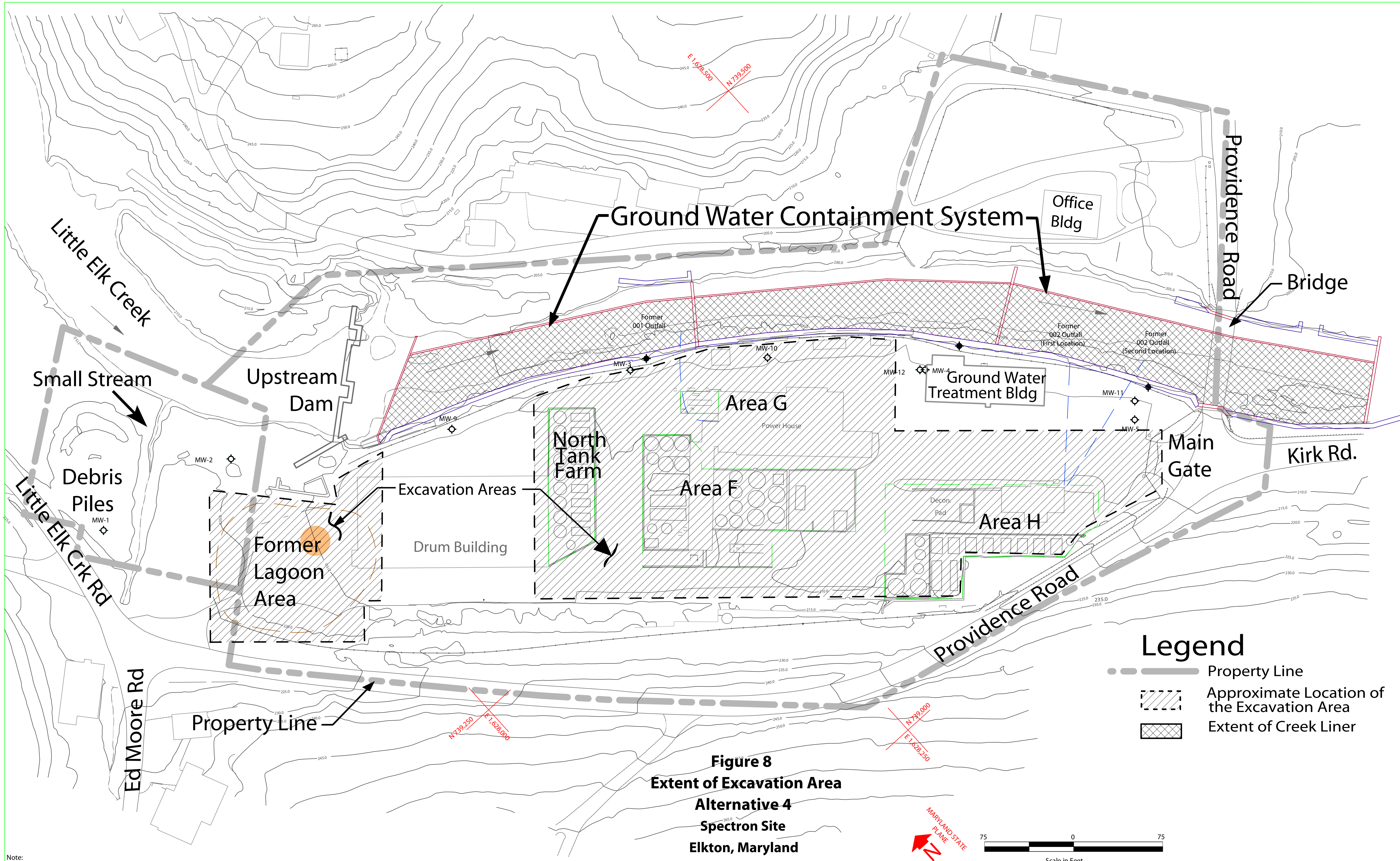


Figure 8
Extent of Excavation Area
Alternative 4
Spectron Site
Elkton, Maryland

Note:
Aboveground tasks associated with process area F and H have been removed

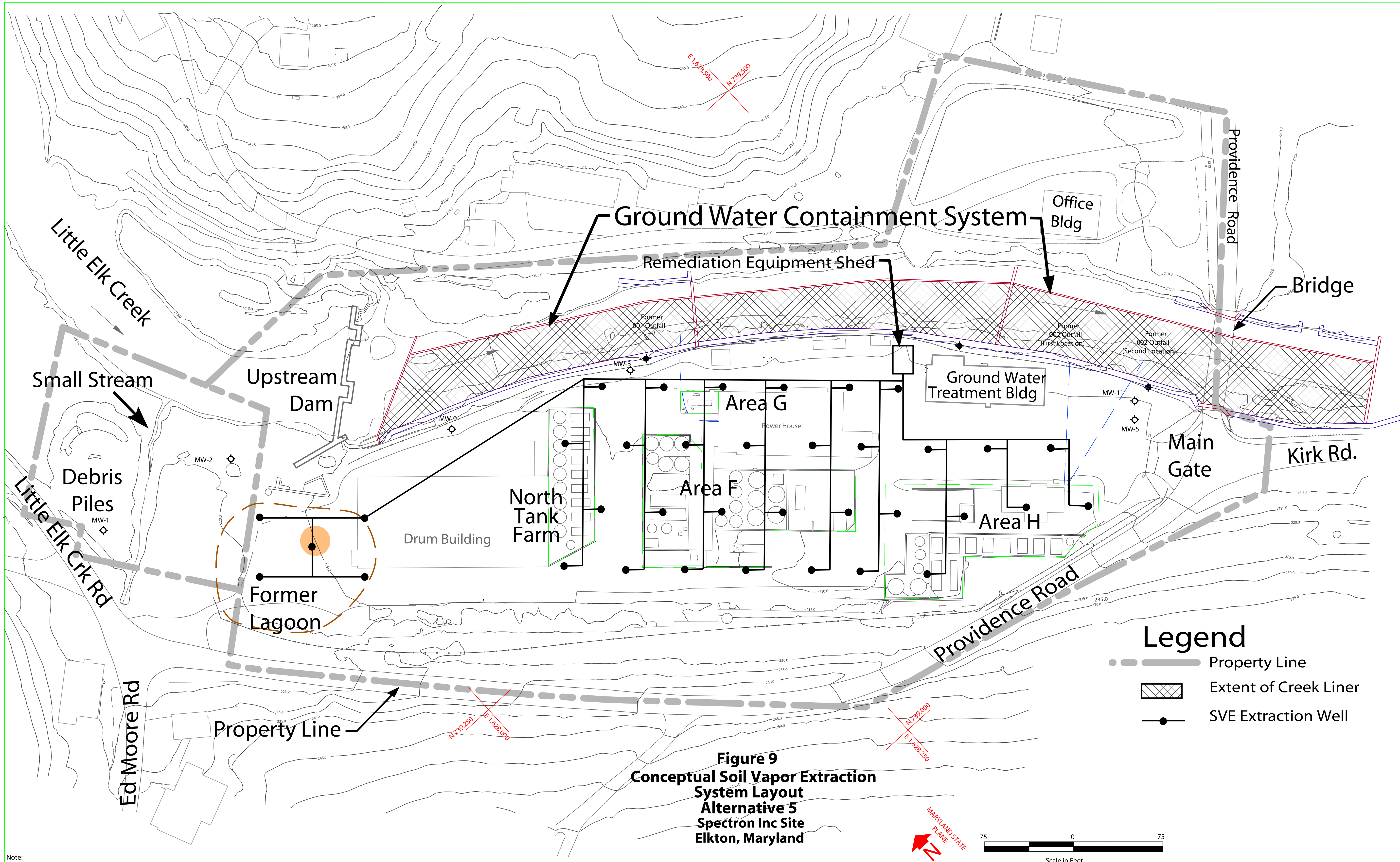
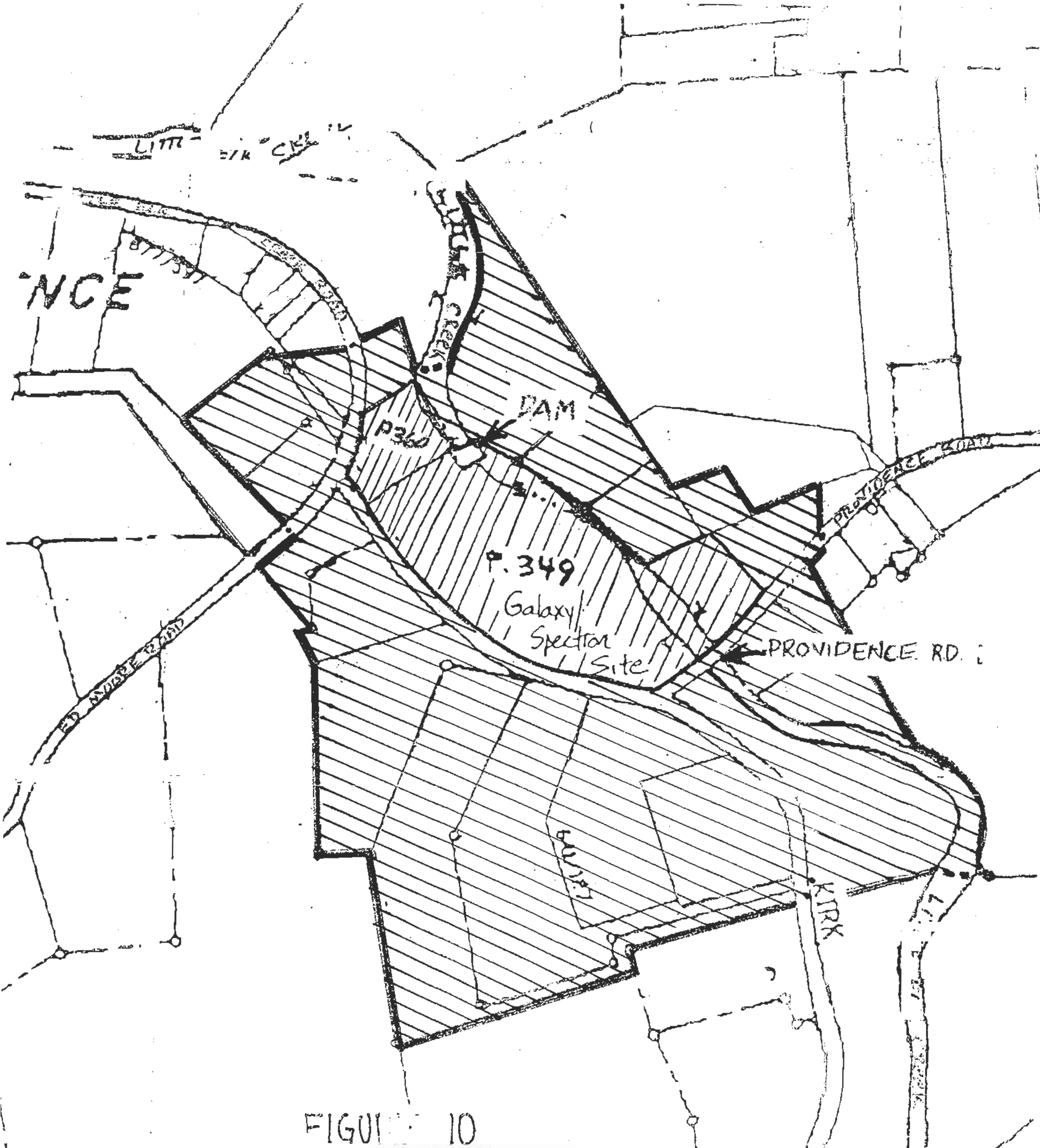


Figure 9
Conceptual Soil Vapor Extraction
System Layout
Alternative 5
Spectron Inc Site
Elkton, Maryland

Note:
Aboveground tasks associated with process area F and H have been removed



FIGU 10

OU NG RESTRICTION AREA
(11.2.5 - PARA. #4)